THE ECONOMIC EFFECTS OF THE FEDERAL PUBLIC WORKS EXPENDITURES, 1933-1938

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NOVEMBER 1940

U.S. NATIONAL RESOURCES PLANNING BOARD

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THE ECONOMIC EFFECTS OF THE FEDERAL PUBLIC WORKS EXPENDITURES 1933-1938

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PREPARED BY
J. K. GALBRAITH, ASSISTED BY G. G. JOHNSON, Jr.
FOR THE
PUBLIC WORKS COMMITTEE

NATIONAL RESOURCES PLANNING BOARD

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EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL RESOURCES PLANNING BOARD
WASHINGTON D. C.

August 21, 1940.

THE PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT:

In response to your request of January 26, 1939, for "information to promote wider understanding of the part which the wise choice and timing of public works can play toward increasing the national income," we are transmitting herewith a report on the Economic Effects of the Federal Public Works Expenditures, 1933–1938 which was prepared under the direction of our Public Works Committee through its Subcommittee on the Economics of Public Works.

Col. H. M. Waite was the Chairman of the Public Works Committee, which consisted of—

Lt. Col. S. J. Chamberlin, U. S. Army
Lowell J. Chawner, Department of Commerce
Corrington Gill, Work Projects Administration
Frank W. Herring, American Public Works Association
A. F. Hinrichs, Department of Labor
F. J. Lawton, Bureau of the Budget
Otto T. Mallery, Economist, Philadelphia
William Stanley Parker, Architect, Boston
F. E. Schmitt, Engineering News-Record
Fred E. Schnepfe, Public Works Administration

The Subcommittee, under A. F. Hinrichs as Chairman, included Lowell J. Chawner and Corrington Gill.. J. K. Galbraith, assisted by G. Griffith Johnson, directed for the Subcommittee the detailed studies and analyses upon which the report is based.

The purpose of the report is to summarize and draw lessons from the experience which the United States Government has had during the past decade in its efforts to use public works construction expenditure as an aid to employment and recovery. These efforts have been varied and their effects complex, and for detailed analysis reference is made to the text of the report.

The continued existence of unemployment as the central economic problem of the United States makes evident the need for planning a public works policy on a long-range basis if the problem of unemployment is to be met in part through the construction of public works. But even if unemployment should cease to be a major national problem, the need for a continuing program of public works construction would not disappear. Orderly administration, economical expenditure of public funds and the sound development of the public plant are all frustrated by annual "emergency programs." They are less effective, and less adaptable to changing conditions than a long-range program with appropriate adjustments in the funds provided annually would be.

Furthermore, it should not be assumed that the problem of developing a long-range public works policy is exclusively a Federal problem. No matter how far the financial and planning leadership of the Federal Government may be carried, the role of the States and localities remains of fundamental importance. Since 1932, Federal programs for construction have had to offset the sharp curtailment that was made from 1930 to 1933 in State and local construction. To return public works expenditure approximately to earlier levels through Federal action was an important accomplishment. However, future public works policy should seek to coordinate forward-looking programs by State and local agencies with those of the Federal Government, to the end that public construction policy as a whole shall contribute more effectively to the rational upbuilding of the national estate and the most profitable utilization of our resources.

Accordingly, we recommend as a matter of long-range Federal policy a continued use of public works construction as one part of a program for employing men and other resources when they would not be otherwise used, and thus add to the total of our national income. Such policy should be properly coordinated with all Federal relief policies and other social security measures, and studies which we now are undertaking have been planned so as to indicate some of the relationships which ought to exist among these policies.

Sincerely yours,

FREDERIC A. DELANO
Chairman

CHARLES E. MERRIAM

GEORGE F. YANTIS

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Acknowledgments

The report of the Subcommittee on the Economics of Public Works to the Public Works Committee of the National Resources Planning Board was prepared under the direction of J. K. Galbraith, assisted by G. Griffith Johnson, Jr., and a technical staff composed of Eleanor H. Wolkind and Doris Lutz Whitnack, and V. R. Bernhard, D. Kelly, and W. R. Norton, Jr.

This study drew heavily for information and assistance on individuals and agencies in several departments of the Federal Government. The most important source of data was the Division of Construction and Public Employment in the Bureau of Labor Statistics. Mr. Herman B. Byer, Chief of the Division, and the members of his staff assisted generously throughout the study and undertook extensive tabulations of basic data. Data on the volume of construction and construction employment were furnished by the Bureau of Foreign and Domestic Commerce in the Department of Commerce, and by the Division of Research, Statistics, and Projects in the Work Projects Administration, now part of the Federal Works Agency. The assistance of Mr. Samuel J. Dennis of the Department of Commerce and Messrs. Peter A. Stone and Andrew Peyton Kerr of the Work Projects Administration is gratefully acknowledged. Much of the information on PWA operations was obtained from the Division of Projects and Statistics of the Public Works Administration, now also a part of Federal Works Agency, and Mr. Matthew L. Devine, in charge of this Division, also directed special tabulations and provided assistance on numerous points. Mr. D. H. Wheeler, Mr. B. W. Thoron, Mr. N. O. Wood, Jr., Mr. L. N. Becker, and other members or former members of the staff of the Public Works Administration assisted on various matters. The manuscript was read in preliminary form by more than a score of people, both inside and outside the Federal service, and their suggestions were gratefully received. Mr. William R. Muench directed the general statistical tabulation, and the charts were prepared under the direction of Mr. Charles Faunce.

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INTRODUCTION[1]

The basic questions of public works policy in recent years have been those growing out of the use of public construction as a partial offset to unemployment and idle capital, equipment, and materials. In the United States we have now had nearly a decade of fairly varied experience with these matters. The main objective of the present study is to review this experience for the light which it may throw on future courses of action. At the same time it has been possible to explore certain of the more general problems of public works policy in relation to general economic policy on the basis of work which has been done in the past few years.

Attention throughout the study has been confined, in the main, to Federal and federally aided construction. Except for purposes of comparison, attention has also been largely directed toward public works, as distinct from work relief construction. In general, public works have been prosecuted under ordinary construction procedures, i. e., through letting of contracts or established "force account" procedures, without regard for the economic status of those to be employed. Work relief, on the other hand, is adjusted in all cases to the relief needs and employment requirements of the individuals to be employed. The needs and abilities of the unemployed have been a primary consideration, both in the selection of work relief projects and in the methods followed in carrying them out.

In chapter I of this study the framework for relating public works policy to general economic policy is laid out. In its ultimate ramifications, the effect of any government economic policy is as broad as the problems of the economic system itself. Arbitrary lines of delimitation must be drawn, and it has been necessary in this chapter to confine attention to the more immediate economic background of public works policy—in particular, to the new questions in public works policy which must be faced when the policy is designed to meet the problem of unemployment. Chapter II deals with the criteria used in selecting specific projects under conditions of unemployment and sketches the criteria which have been used in recent years.

The effect of different levels of public construction upon the economic system can only be appraised from examination of past experience. This is undertaken in chapters III, IV, and V. In chapter III the effect of the public works activities of recent years is related to the level of construction and business activity and to the volume of output in the immediately affected industries. In chapter IV measurements are made of the volume of public works employment both on and off the site of construction, and these are related to the level and distribution of unemployment. Chief attention has been directed in both chapters to those effects of public works activity which are statistically identifiable. Certain qualitative considerations bearing upon the further employment from the respending of increased incomes resulting from public works activity are introduced in appendix B. Chapter V is a general appraisal of the effects of the public works construction of recent years on the course of costs and prices in the construction industry—factors which, in turn, may affect the level of private construction.

Chapter VI is concerned with questions of administration and timing. It undertakes to measure the time required to advance public works to the start of construction, and the rate at which employment and orders are forthcoming after construction begins.

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[1] The manuscript of this study was completed in substantially its present form during the autumn of 1939. It has not been revised in accordance with subsequent developments.

CHAPTER I—PUBLIC WORKS POLICY AND UNEMPLOYMENT

The term "public works," in common usage, has reference to a public activity of fairly definite sort. The term implies, generally, public construction of a relatively durable kind; in fact, that part of governmental activity which is devoted to producing public works is set apart from other activities mainly by the comparatively long life of the structures which result. It is by reason of this durability that we think of a post office or a canal as a public work and do not regard similarly the maintenance work which is applied each year to the lawn of the post office or the locks of a canal.

There is more to the idea of public works than durability, however. Naval vessels and heavy army ordnance are comparatively durable but are seldom considered as public works by the average person. Government purchases of rather durable transport equipment are also rarely considered a public works acquisition. To the idea of durability it is perhaps necessary to add immobility or fixity on the site of construction to bring the general definition into accord with popular usage. Further, the idea of a public work implies a certain magnitude or scale of activity; it suggests something in the way of heavy or special construction as opposed to lighter and more routine activity.

Perhaps more because of its durability than for any other reason, public works construction has come to occupy a position of special interest in the political economy of nations. Not only are public works concrete, self-advertising evidence of a contribution by the Government to the individual welfare, but the evidence endures. In the nature of the case, public works expenditure means building for the future, and, to some extent, we have come to gage the far-sightedness or idealism of States by the extent to which they make these permanent and visible contributions to future welfare. Partly for this reason, there is, perhaps, some danger of overestimating the special usefulness of public works. For, so far as any individual or group can presume to judge, public works must stand on a parity in terms of usefulness with the other things which the Government provides. Permanence or concreteness as special qualifications or criteria of value evaporate on closer examination. A dam is, in a sense, vastly more permanent than an education or a defense against an annual invasion of grasshoppers. It cannot be argued that the dam is inherently more useful. It is assumed in this study that, so far as the utility rendered the community is concerned, the services rendered by public works are, by their nature, in nowise peculiar among the services which the government performs for its citizens.

Although the provision of public works cannot be considered inherently either more or less useful than other governmental activities, their durability has significance in another respect. Whereas the great bulk of public services requires a given expenditure in the year in which they are launched and an expenditure of corresponding size in succeeding years, the services of public works are bought by a lump outlay for their construction and, in most instances, a more moderate charge for operation and maintenance in all succeeding periods. Hence the outlay and employment to obtain the services of a bridge or a building for an indefinite period in the future is in large measure concentrated in the present. In contrast, the outlay to obtain health protection is spread more or less evenly over the period during which the health of the community is being protected. It is this feature of public works, the fact that much of the expenditure for a long period of service is concentrated in one relatively short period, which first led people to consider the timing of public works construction in relation to business activity.

The Level of Public Works Expenditure With Full Employment

When everyone is at work in a community the determination of a desirable level of public works expenditure is not, in principle, a complicated procedure. To construct a public work means that men and materials will not be available for other production, chiefly other construction. To the extent that the legislature interprets the will and disposition of the people correctly, it will appropriate for and build additional public works up to the point where people feel the sacrifice of private works, other public services, or consumers goods more keenly than they appreciate the benefits from the additional public construction which is contemplated. Paralleling the transfer of men and materials from private production to public works construction will be a transfer of funds from private expenditure to public expenditure. The State borrows or taxes funds which would have been privately expended or used for other public services and devotes them to the building of public works for which the community has expressed a greater demand. Over a period of time in the future, if it borrowed, the State taxes funds from the community at large and repays the amount borrowed from those who saved and loaned to the Government; it was restraint from current consumption, through saving or taxation, which freed the men and materials and made possible the construction. The important point is that, when men are fully employed, the amount of public works construction is, in some ideal sense, set by the demand for public works in comparison with the demand for private production on one hand, and by the demand for other services of public expenditure on the other.[1] As presented to the legislature, the question is whether the community at large would prefer more post office buildings, harbor improvements, or road construction, or if it would choose the objects of private expenditure which would be produced instead, since it is assumed that employment would in any case be at capacity.

Public Works Policy Under Conditions of Unemployment

When extensive unemployment exists public works policy is no longer determined thus simply. Unemployment has two effects. In the first place, if there is unemployment, the combination of idle men and idle materials means that the community can obtain an increase in the amount of public works construction without any corresponding reduction in private production. In other words, unemployment introduces the choice, not between employment in public works construction and private or other public employment, but between public works employment (and other methods of employing people) and a corresponding volume of unemployed men and materials. In the second place, when private employment is below the maximum where all are employed, then the introduction of new public expenditure with spending and respending of the proceeds will itself affect the level of private employment.

Under conditions of general unemployment, the desirable volume of public works construction is related to the level of unemployment, assuming, of course, that the Nation is not yet fully and adequately provided with all the physical facilities it will ever need. However, there are other activities of the Government which are similarly related to the amount of unemployment, and for this, as well as for other reasons, the relationship is a complex one. The provision of public works is a useful alternative to idleness, but so are other types of governmental activity: education, conservation, pest and disease control, and a host of other things. The construction of public works is but one branch of public service; this fact should not be disguised, as it has sometimes been in the past, by the circumstance that a public work is physically durable.

Furthermore, the impact of public works expenditure, while broad in its secondary and tertiary effects, has its primary effect on one industry, namely, construction. The construction industry has been deeply depressed in recent years, but it has not been the only depressed industry. Expansion of public works building beyond a certain, if somewhat remote, point would obviously involve difficulties in fitting the pattern of public works employment to that of private unemployment.

When one speaks of employment on public works construction in relation to unemployment in its recent volume, it must be clearly recognized that only a part, and perhaps only a small part, of the unemployment problem can be met in this way.[2] It is one of the central tasks of the present report to discover, for different levels of public works expenditure, how great this part will be.

Business Fluctuations and Public Works Policy

At the present time, it is possible to identify at least four broadly different views of the relation of public works expenditure policy to the problem of business fluctuations and concomitant unemployment. Each of these envisages a different role for public works construction expenditures in the corrective process. It is not to be assumed that in any of these views public works activity is considered the only (or necessarily even the most important) device by which the Government may combat unemployment.

First among these broad categories of employment theory is that which sees no place for increased public works spending at all during periods of unemployment. The normal condition of the economy, in this view, is one of full employment with a neutral fiscal and monetary policy. Depression and unemployment are temporary deviations from this full employment norm and, moreover, are held to be essentially self-corrective if left alone. The unemployment itself is accompanied by a writing down of private debt, or a curtailment of hitherto excessive investment, or a lowering of prices, wage rates, and interest rates; these processes in turn produce recovery and a return to full employment. Public works activity which would delay the writing down of debts, maintain investment,[3] or check the fall in wages, would likewise inhibit recovery.

The second view also takes, as a point of departure, the assumption that full employment of all who are seeking work is the normal or equilibrium situation. In other words, depression and unemployment are viewed, in the main, as temporary fluctuations below this norm. But this view does not emphasize the corrective effects, per se, of unemployment and the corresponding deflation of debt and income levels. Public works expenditure is viewed as softening the depression without delaying recovery. Consequently, while there is no justification in this view for a net expansion over a long period of years in public works expenditures, there is advantage in doing as much as possible of the total in times of depression. In good times, employment is full, or at least relatively so, and public construction can give way to private production without diminution in employment. During depressions, this view holds, the accumulated deficit in public works should be made up, and future needs anticipated. During the next period of prosperity public works activity can again be diminished. Nearly all of the early proposals for countercyclical timing of public works were based on some such view of the cycle as the one here indicated.

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[1] As a practical matter, this ideal would never be more than approximated, even assuming full employment. There is, of course, the question of how accurately the legislature interprets the desires of the people. Furthermore, political power is never evenly distributed. Various interested groups are likely to exercise special power in encouraging or resisting public works expenditure.

[2] Particularly in ch. IV.

[3] And, in the usual argument, cause it to remain in excess of savings, which was the presumed cause of the difficulty.

The third view of unemployment in relation to public works activity abandons the notion that unemployment and depression are self-corrective. It assumes that the depression will be ended only by active Government intervention to maintain purchasing power and employment. It emphasizes the deflationary downward spiral and the need for helping to recreate an upward movement of private profit, private production, and employment. One of the devices for accomplishing this is an expanded program of public construction financed from reserves or borrowing. This should begin with sufficient promptness to check or temper the downswing, and it is expected to prime the pump for a new upswing. As in the second view, when full employment of men and plant is achieved, it is expected that the increase in public employment will give way to an increase in private employment. This is necessary to avoid having liberal public and private undertakings in competition in the markets for men and materials, with attendant danger of inflationary increases in prices and wages.

The difference between the second and third views turns upon the question of whether the depression will end itself. In the third view, vigorous public action is necessary to restore prosperity. The role of public works expenditure in this view cannot be limited by some notion of what is "normal" over a period of years. The amount of emergency construction is governed by the seriousness of the problem; at times a very large expansion may be called for.

All the foregoing views of unemployment join in regarding it as a product of the business cycle, of periodic fluctuations, however caused, below full employment. The fourth view of the problem abandons the idea of the business cycle as the central source of unemployment and makes unemployed men and materials the normal or equilibrium situation in the modern economy. Again the explanation takes different forms, but the most cogent argument runs in terms of the changed character of private investment in modern times. It is held that during the nineteenth century a rapidly increasing population, a frontier to be developed, and an abounding optimism all helped to keep private investment at a high level. The frontier and the period of rapid population increase are now passed, although the effect of their passing was disguised by the Great War and the development of certain new industries, among them the automotive industry, in the years following. Private investment, it is held, now lacks the opportunity and tempo which formerly caused it to absorb our large supply of savings and employ all or a large proportion of the national labor force.[4]

In such a view of the unemployment problem, an entirely new role may be assigned to expenditures for public works construction. It is no longer something to be planned in relation to periodic slumps in private employment; it is something (along with other public activity) to be placed in relation to a continuing low level of private employment. If the idle men and resources are to be used, then the building of public works is to be considered a continuing supplement to private investment. In practical terms, it is argued, the "works" program of the latter half of the nineteenth century consisted in building most of the cities and nearly all of the farmsteads west of the Mississippi, with much "frontier" investment to the east as well. This period of rapid building is now over, and the unfilled gap in investment is held to be one source of unemployment. From this point of view, the construction of public works becomes one way of taking up some part of the slack in private investment on a continuing basis; construction of public works, so financed as to offset otherwise idle savings, represents one of the devices for escaping a persistently low level of private investment and a persistently high level of unemployment.

In the United States, at the present time, only the third and fourth views of unemployment come in for primary consideration in the shaping of public works expenditure policy. The view that depressions will correct themselves if left alone is by no means dead, but there is grave doubt if it is likely to become again the basis of public policy. The idea of depressions so mild that they could be markedly softened by normal[5] public works programs, shifted forward or backward to coincide with the slump, has not been supported by recent experience. In recent years we have seen changes in national income of tens of billions. The possible range in expenditure on a normal public works program, even assuming that local governments did not, as at present, actually reduce expenditures during depression, is measurable in hundreds of millions. The two magnitudes of change, in national income on the one hand and the possible adjustments in normal public works programs on the other, do not stand in any close relation to one another.

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[4] Economists are by no means agreed that this necessarily leads to permanent unemployment. Some would say merely that it presages a change in the ratio of the production of capital goods and of goods and services for consumption. There would be wide agreement that, in the period of transition to a new balance, there would be severe unemployment. The experience of recent years suggests the magnitude of the strain.

[5] By "normal public works programs" are meant those which would be undertaken quite without reference to the unemployment situation. The idea is, of necessity, somewhat ambiguous.

Public works construction expenditures in relation to employment present, then, the following questions: (*a*) Are such expenditures to be considered a measure to aid in the stabilization of employment by expansion beyond the normal level during periods of depression, with the prospect that they will be restored to a normal level or below at some later period; or (*b*) is a substantially expanded public works program (as compared, say, with the 1920's) a continuing necessity in the forseeable future for which long-term policy decisions must be made? These questions are important for the discussion which follows.[6] In the first case, for example, the problem of public works planning would appear to be one of having ready a portfolio of works projects which can be launched promptly whenever private employment subsides and which can be curtailed equally promptly when private employment responds. Considerable emphasis will be placed on the flexibility of the projects; important works will, as in the past, be ruled out if they are of such character that they cannot be started or terminated with reasonable promptness. If, on the other hand, we are to look forward to a permanently enlarged program of public construction, then the problem is quite different. Questions of timing are less important and the utility of the projects to the community is probably of increased importance. New questions arise concerning possible fields to be opened to public development, the way in which new public works may be used to induce or promote private investment over a period of years, and the types of works appropriate to a continuing public works program.

However, the issue should not be exaggerated; it is entirely possible that theoretical disagreement as to the ultimate level of employment may not lead to a materially different immediate attitude toward public works. Most economists would agree that fundamental trends work themselves out rather slowly. It is not unreasonable to assume that as much as 10 years might be necessary under the best of conditions, averaging good years and bad, for private expansion of business to absorb those presently unemployed. Thus, need for an expansion of public works employment for an indefinite period would be granted by large numbers of economists who regard large-scale unemployment as certainly enduring over short but not over long periods.

For the present, it seems desirable to assume that public works policy in the future should be capable of adaptation to a dual role. There will be periods in the future when it may be desirable to expand public works construction to accord with major downswings in private investment and employment. While, as later chapters will indicate, fine adjustments to movements in private employment cannot be expected, a considerable measure of flexibility in expansion and contraction of public works projects will still be required to accord with such situations. This is more than a Federal problem, for expansion of Federal construction during depression should be combined with the greatest possible stability in State and local construction. In addition, we must at least reckon with the possibility that a permanently expanded volume of public construction may be needed to meet continuing unemployment. We must keep in mind, in other words, the requirements of a long-range program for meeting a long-range problem of unemployment. Whether the need for such a program will actually arise is something which only the future itself will decide; the present study merely accepts this possibility as a factor in public works planning.

The Financing of Public Works

While major attention in this study is centered upon public works policy in relation to employment and business activity, there are certain matters concerning the financing of public works which require brief comment. Without entering exhaustively upon this aspect of public works policy, it is necessary to examine certain points of view which have long been associated with public works financing. It is also necessary to set out certain assumptions with regard to financing which are made in the present study.

It has always been supposed that there is a special justification for borrowing to finance permanent durable public construction, and that under normal conditions public works will be paid for by loans.[7] The economic justification for this is vague; much of the vagueness is attributable to loose analogies between public and private accounting, and to the assumption that the issues are exactly the same for the Government of the United States on the one hand and for the government of a Vermont town or a Nevada mining village on the other.

To put the matter simply, a private corporation finds it justifiable practice to borrow, if necessary, for any expenditure which will have a long-time favorable effect on its income. It can, in general, find justification for increasing its debt (not necessarily its capitalization) whenever the object acquired—plant, machinery, and the like—will add revenues to the concern sufficient to pay the interest and amortization of the loan. In accounting practice it usually anticipates repayment of the loan within some period less than that in which the capital item acquired is returning revenues to the plant, i. e., the period of the loan must always be less (and is usually much less) than the real depreciation period of the capital equipment acquired.

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[6] See ch. VI.

[7] Although this has by no means been the practice so far as the Federal Government is concerned.

Furthermore, long-term borrowing is ordinarily resorted to only for capital improvements which are relatively costly in relation to the current revenues of the concern. The same rate of return in relation to cost and interest must theoretically be made whether the improvement is large or small. However, aside from the possibility of drawing on reserves, firms do not resort to borrowing for improvements unless the cost of the improvements is beyond the scope of current revenues. In practice, a great volume of capital equipment is financed each year from current income.

Thus, apart from certain considerations which may make a concern unwilling or unable to increase its debt under any circumstances, and apart, also, from borrowing for terms less than the period of production (i. e., borrowing for liquid capital), a business concern will ordinarily increase its debt in accordance with two considerations. It will borrow when it can enhance net revenues by more than the cost plus interest, and when the cost is very large in relation to current revenues. It follows that only capital structures or equipment of a rather permanent or durable sort are likely to fit this qualification. The final aspect of the transaction is that the capital equipment acquired serves in greater or less degree as the security for the loan.

It has been necessary to set out this rather familiar formula for private financial procedure because it is in the area of private enterprise that most of the ideas on borrowing and loan repayment have been born. Ideas which have been developed for the individual or the private business have been carried over by analogy into public accounting and fiscal policy. There is no a priori basis for any analogy between a private individual or private corporation engaged in the specialized activity of making money, and a complex governmental organization concerned not with making profits but responsible instead for the welfare of its community. It is true that when one passes from the field of private to public finance most of the ideas which have validity in private business either lose their real meaning or become confused.

So far as the Government of the United States is concerned, there are few criteria for borrowing which resemble the justification for borrowing by a private business.[8] To borrow for a major public work—a dam or a large public building—is rarely to borrow against specific revenues returnable to the Government from the project in question. In the case of non-self-liquidating projects, it can be argued, of course, that the national productive plant is enhanced and the loan is made against the increased national income which results in the future, but this is largely without meaning. Almost all activities of the Government affect the national income in the future; a research project for blister rust control, a grant of funds for vocational education, or the support of a CCC camp all have the same effect. To attempt to determine, by examining their effect on national income, which expenditures of the Government should be currently financed and which should be financed by loan is out of the question. One would have no accounting, one way or another, of some very useful activities of the Government—parks, recreational areas, and the like—which render their service in nonmonetary satisfactions which do not show in ordinary calculations of the national income.

So far as the Federal Government is concerned, very little more can be made out of nonrecurrence or durability as a criterion for borrowing. In private financial policy such borrowing is justified by the unusual or exceptional charge which is placed upon the current budget. In the budget of the United States there are always a large number of durable or nonrecurring items and, while any one item may be unusual or exceptional, the existence of nonrecurring items as a whole is entirely normal. Expenditure for a particular post office is not recurrent; expenditure for post offices in general is recurrent. It is clearly impossible to argue that post office construction may better be financed by borrowing because it is nonrecurrent. And just as expenditure for post offices as a whole is normal and recurrent, so building expenditure as a whole is normal and recurrent. Changes in the level or volume of building may justify changes in the method of financing, but that is another matter. Finally, the idea that public works stand as security for public loans of the United States has no meaning.

There is, then, no necessary connection between public works expenditure and public borrowing so far as the Federal Government is concerned. The financing of public works is governed, not by the peculiar characteristics of public construction, but by the fiscal policy of the Government as a whole. If it is the fiscal policy of the Government to pay all expenses currently, to take in currently as much money as it spends, then public works may, quite justifiably, be financed in the same way as army pay or the rent of office space. Under conceivable conditions of full employment this would be an eminently desirable policy. If, on the other hand, the fiscal policy is one of deficit financing, then there is no reason why the deficit should be limited to the expenditure on durable public construction. It may equally well be less or greater and by any amount, depending on what is called for by the taxation policy and the expenditure policy of the Federal Government at the time.

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[8] The alternative rental expense is a factor in public building policy. However, the rental charge itself is rarely related to any specific return or profit.

It is now possible to state an important assumption which underlies the present study. Whether the employment and business activity resulting from a given public works expenditure will be a net addition to, or merely a substitute for, the employment and activity which would exist anyway depends not only upon the level of employment as already noted, but also upon the fiscal policy of the Government. So far as the level of employment is concerned, it has been argued that if there is general unemployment the launching of public works construction will not involve the withdrawal of workers from private employment and for that reason the curtailment of private activity. This situation is assumed to have held during the period of the 1930's which we are examining. A similar assumption is made with respect to the fiscal policy of the period. If the fiscal policy contemplates borrowing for public works, an increase in such expenditures does not involve a parallel reduction in private expenditures and employment. Since the past decade has also been one of deficit financing on the part of the Federal Government, it is assumed, so far as fiscal policy affects the picture,[9] that Federal public works activity did not trench upon private spending and, therefore, was an addition to, rather than a substitute for, private employment. It is further assumed that a similar use of public works in the future will be so arranged and instituted that taxation will not result in a current reduction of private spending, at least in a magnitude commensurate with the magnitude of the public works expenditure.

In the case of local and State governments, there is a connection between public works and borrowing. Except to some degree for self-liquidating works, and for those improvements which can logically be expected to raise property valuations and consequently increase real estate tax returns, the private calculation of an enhanced return from the work sufficient to cover interest and amortization has no application. The idea of recurrence and nonrecurrence does, however, gain some significance which increases as the unit of government involved becomes smaller. Whereas building is always normal to the United States Government and likewise, in slightly less degree, to the City or State of New York, the construction of an important building is abnormal or extraordinary for most municipalities. Because of the episodic character of construction in relation to the total budget, public works in small municipalities are directly associated with borrowing. It should be noted, however, that the community borrows not because the public works are durable, but because the expenditure is extraordinary; because it is beyond the scope of any one year's budget and will not recur in subsequent budgets. Except in rare cases where the municipality approaches very closely the status of a private corporation, the structure acquired has little or no significance as security for the loan; to argue that the loan should be repaid within the life of the structure means that it should be repaid before another extraordinary expenditure is required. Thus, while a connection between public works and borrowing exists in the case of municipal finance, the connection is by no means peculiar to public works. Other extraordinary expenditures, such as relief following natural disasters or exceptionally heavy expenditures for unemployment, stand in the same relation to borrowing as do public works. This means, in other words, that for these levels of government, also, it is the fiscal situation rather than the object of the expenditure which is the logical criterion for borrowing. In practice, particularly in recent years, local governments have made fiscal urgency, whatever the object of expenditure, an important reason for borrowing. In doing so they were probably proceeding on rational lines.

While the upshot of this discussion is that public works, by their nature, do not justify or require any particular form of financing, a broad policy of public expenditure to counteract unemployment does have a special fiscal significance. Because expenditures for public works are likely to bulk large in such an employment policy they share its financial implications. The issues in financial policy which arise here, the most disputed of which is the effect on public debt, are reviewed in appendix A. Certain differences in this connection, between the position of the Federal Government and that of States and localities, are also discussed.

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[9] This assumption is only that the fiscal policy is such that expansion of public works does not reduce private spending. There are other ways in which an expanded public works program may have this effect. Much has been made of its effect, pro and con, on business confidence, but this obviously cannot be brought within the scope of a quantitative study. Public construction may also have an adverse effect on private construction through raising costs unduly. This aspect is treated in ch. V.

CHAPTER II—THE PLANNING AND SELECTION OF PUBLIC WORKS IN RELATION TO UNEMPLOYMENT

In the preceding chapter, public works were discussed without differentiation between the numerous lines of public construction which have been undertaken. The question of what kinds of public works are to be favored under different conditions is also important. An attempt must be made at the outset to define, in general terms, the criteria which bear upon the selection of different kinds of works when the public works policy is related to the problem of unemployment.

To begin once more with a condition of full employment, a condition in which public works projects can be selected for construction without reference to an idle labor force which is thereby used wholly or in part, one again finds the problem much simplified. The ruling consideration under such circumstances, ideally at least, is the utility or usefulness of the works to the community. People are willing to forego private expenditure in order to have public goods; quite naturally they want, as a result, the most useful of these goods. There are many questions, in a democratic country, of the correctness with which the legislature can interpret the desire of the community, but the ideal of maximum usefulness is clear.

In recent years, the initiative to public works activity has come not only from the communities' desire for the works themselves, but also from the idle resources available for their construction. The problem has not been one of replacing private employment with public employment, but of using public employment as an offset and partial corrective of unemployment. The question is: What are the criteria for selecting works projects when they serve not only the demands of the community for useful construction but also as an offset to unstable and insufficient private employment?

When there is general unemployment in the economy, and public works construction is to be utilized as a means of mitigating it, six considerations bear in some degree upon the selection of the particular kinds of public works to be undertaken, as follows:

1. The utility of the work to the community;
2. The flexibility of the project, the ease with which it can be undertaken at the appropriate time, and the ease with which its prosecution can be controlled or curtailed in relation to the need for rapid expansion or contraction of employment;
3. The adjustment of the project to the character and regional distribution of unemployment;
4. The adjustment of the material requirements of the project to available industrial plant capacity;
5. The employment-creating value of the project;
6. The extent to which the project induces further new investment and employment.

Nothing more need be said about the factor of utility. Quite obviously public works projects must be useful and, while interpretations of the desires of the community will differ, it is fairly certain that adequate attention will be paid to this requirement. Experience of recent years has shown that the country as a whole brings a critical judgment to bear upon the usefulness of public construction and upon the public officials who make the selection of projects.

The question of flexibility presents, as the preceding section suggests, something of a dilemma. Promptness in beginning operations is important if public works construction activity is viewed as a counterbalance for cyclical fluctuation; it is less important if such activity is designed to meet a condition of enduring unemployment. Moreover, demand for a rapid rate of prosecution would be markedly less significant if we had a public works program which received approval at the most propitious time. As it has happened in recent years (in 1933 and 1938 particularly), the legislative appropriation for an expanded public works program was delayed until long after a serious unemployment situation had developed. Once the appropriation was made, there was great pressure for results, and projects which could be started quickly were in demand. Had legislative provision been made further in advance, or had action by the administrative agency been contingent upon the development of unemployment and the need for action, the pressure for flexible projects would have been much less.

It must be concluded, therefore, that flexibility is not an absolute but a contingent requirement of a public-works program that is planned in relation to unemployment. A high degree of flexibility in beginning and terminating projects is necessary only if the program is designed for short-run countercyclical effect, and only if appropriations are subject to last-minute action, as in recent years. In all cases, however, a distribution of available projects between those which can be started and stopped quickly and those which take more time will be necessary. With the best planning and advance provision there will be times when it will be necessary or desirable to increase the volume of works construction quickly. This will be true even though it is part of a permanently expanded program of government support to employment. Likewise, should private employment and investment recover, a contraction of public works employment represents one of the controls which the

Government has at hand to check boom expansion of activity and inflationary increases of prices and costs.

Thus, in setting up flexibility as one of the factors bearing upon the selection of projects in such a program, one cannot conclude that flexible or quick-starting, quick-stopping projects are, per se, the most desirable. The objective is rather to know the degree of flexibility of various kinds of construction, to have all classes available, and to select from among the various classes in accordance with the need for flexibility. In chapter VI a preliminary effort is made to measure the comparative flexibility of different classes of public works construction as indicated by the experience since 1933.

The central issues concerning the adjustment of public works projects to unemployment are fairly clear. Unemployment occurs in the economy with two parameters of variation. It varies widely by regions, and it also varies greatly by classes of workers, i. e., as between unskilled workers and various classes of skilled workmen. As a general principle, the geographical situation of unemployed workers must be taken as a datum; while local movements occur freely enough, distant migrations by those seeking public works employment cannot be expected. This means that projects must be regionally distributed to accord with the regions of unemployment, although, of course, they should not go so far as to check desirable regional adjustments in the location of the labor force. The agency administering a program of publicly provided employment can, within limits, distribute projects to accord with unemployment, and the density of unemployment will continue to be an important criterion in the selection of projects.[1] The details of this adjustment are considered in chapter IV.[2]

Distribution of projects in accordance with available skills is less important, first because it is possible to do less about it, and secondly because the demand for most classes of workers is likely to fall short of the available supply. This at least has been the experience of recent years. Some judgment can be exercised in selecting projects which have a high unskilled labor requirement in view of the tendency for unemployment to be heavily concentrated in this category. But, on grounds of broad national policy, an equally good case might be made for projects which force the training of skilled workers, and which thereby counteract the well-recognized tendency of unemployment to cause obsolescence in the labor force. Against the background of a long-range public works policy, attention to the selection of projects so that training would accord with longer trends in occupational requirements might be both feasible and desirable. But the mere adjustment of skill requirements to available skills does not seem to be an issue of acute importance in public works policy.[3] No further consideration has been given to this problem.

The adjustment of the material demands of a public works project to available plant capacity seems also to be a matter of relatively small consequence. However, one of the standing justifications of public works expansion during depression has been the exceptionally heavy contraction of output in the construction and construction supply industries at such times. It would appear to follow logically from this that the best public works program would be composed of projects which draw heavily on the more seriously depressed industries. The issues here have not always been clearly thought through. Industries which are most severely depressed are likely to be those which can increase production by offering the minimum of employment. Not only is it possible that they will have stocks which they will seek to reduce, but they are by definition industries in which wide expansion in output is possible with a minimum of expenditure on new plant and machinery. Moreover, there is an additional, a priori, likelihood that they will squeeze the largest possible part of increased revenues into reduction of bank loans and similar commitments. While the long-run effect of this is important, the short-run effect will be to keep secondary expenditure in such industries at or very near the minimum. In contrast, orders placed with more favorably situated industries may induce some plant expansion or lead to additional investment. The effect of the expenditure on the level of income is accordingly greater.

Except in a limited number of industries [4] the possible volume of public works orders tends to be of very moderate size in relation to the capacity of the industries concerned. The play in the system which results would almost certainly keep the effects just discussed to small proportions in any possible case. It is doubtful if public works could, in practice, be selected for their expansive effect on existing plant; it is equally doubtful, on the other hand, if any attempt should be made to select projects merely to accord with higher degrees of idleness in plant capacity.

The employment-creating value of different classes of construction projects is a matter which does appear to merit consideration in a program such as we are discussing. There has been some disposition to consider public construction expenditure, and even all public expenditure, more or less homogeneous in its effects on employment. There is no basis for this view. The amount of employment provided, off-site and on-site, by a given expenditure on different classes of projects depends on several things, and the possible variation is considerable. In the short run, and apart from the question of inventory withdrawals, projects which require a relatively large amount of unskilled labor or a relatively large amount of hand labor (or both), and types of construction where profits are low naturally, will offer more man-hours of employment for equal expenditure than projects where the opposite is true. Measures of the employment provided per unit of expenditure on different classes of construction cannot be worked out with complete precision, and the conditions determining the amount of employment are subject to considerable change. Nonetheless, the estimates are worth noting, and they have been reviewed in some detail in chapter IV.[5] They indicate an important variation between various classes of construction in the employment provided by a given expenditure. Where the creation of employment is a primary objective of public works activity, these variations, with due regard for the necessary differences in cost of employing skilled and unskilled labor, should at least be recognized.

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[1] In practice, it may be noted, the more refined adjustments of workers to employment can be better done by the work relief agency.

[2] It is suggested there that one of the important effects of a satisfactory regional distribution will be a continued and perhaps increasing emphasis on non-Federal works projects with their correspondence to areas of dense population; with some major exceptions there will be a smaller emphasis on Federal projects with their tendency to migrate to the far West, the District of Columbia, and other centers of activity of the Federal Government which bear no close relation to the distribution of population.

[3] There is, of course, the further and much discussed possibility of adjusting the technical methods employed to the labor supply, chiefly by substituting hand labor for machine construction. This, as well as adjustment of skills to jobs, is important in work relief policy.

[4] See ch. III, pp. 34, 35.

The direct investment and employment-inducing[6] effect of different classes of public works in relation to private investment and employment is a matter which has received far less attention than it deserves. The construction of a public works project can directly bring about changes in private investment and employment in several ways. It may conceivably bring increased investment in private plant and machinery by pressing upon existing capacity of concerns which supply materials. This possibility has always been recognized although, as suggested earlier, considering the play in the system, its immediate practical significance is probably small.

A second effect on private investment and employment comes through the completed project itself; the fact that the new structure is in existence affects the volume of private investment. In some cases the effect of a public works project on private investment may be negative; particularly if the new facilities are to provide services competitive with existing services privately financed. But wide degrees of positive effect may also be expected. The completion of a reclamation project brings private investment not only in farmsteads, farm equipment, and the like, but also in shopping centers, motion-picture houses, garages, and a variety of other enterprises.

A successful reclamation project is an outstanding example of a public improvement which induces private investment and employment. There are, however, many possibilities and degrees of such effect in the case of different kinds of public works. In the case of roads, the induced investment may be small or negligible when an existing pavement is being renewed or widened. A new highway, on the other hand, brings at the very least a considerable induced investment in filling stations and roadside enterprises, and there may be far greater effect in the opening up of important new areas and resources for development. Important arteries near dense urban areas, which contribute to residential and industrial investment, may be important. Even a new post office, which in a country village will be entirely neutral in its effect on private investment, in a larger center may substantially increase the investment in nearby mercantile establishments. The nature and extent of the investment-inducing character of different classes of public works present an important field for investigation, which, however, has been beyond the scope of the present study. The experience following the earlier public works programs is now sufficiently mature that sample investigations of the resulting private investment in different cases might be undertaken without undue difficulty.

In summary, when a public works program is to be administered in relation to employment, the first criterion in the selection of projects continues to be usefulness. But within the range of useful projects a complex of other factors bears upon the choice. Flexibility, the ability to begin promptly, remains an important requirement, although its importance depends on the timeliness of legislative provision for any given public works program. Moreover, need for flexibility consists not so much in having a program composed of projects which can be quickly started and quickly stopped as in having one composed of projects of known flexibility so distributed as to be adequate for the situation in which it is launched. Three further matters bear upon the kind of public works to be undertaken. The regional distribution should be adjusted to the distribution of unemployment. Having regard to the kind of labor needing employment, the labor-creating value or employment efficiency of the projects should be as high as possible. Finally, the private investment and employment-inducing effect of the work is a matter for careful consideration.

Project Selection Criteria of the Public Works Administration

In Public Works Administration practice since 1933, all of the foregoing criteria have been given some measure of consideration in the selection of projects under its jurisdiction, and some general observations may be made at this stage. It should be noted once more that the exigencies of delayed appropriations have placed a premium on the criterion of flexibility in nearly all of the programs. It would seem a fair observation on Public Works Administration practice, that the speed with which projects could be started and completed has been, perhaps, the major criterion in the selection of projects.

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[5] See pp. 53 to 54.

[6] The effects on private investment here described as "direct" are by no means the only ones. By raising costs and stimulating or shocking business confidence, a public works program may affect private investment.

Practical experience has shown, however, that two other factors have also been of major importance in the selection. First, there is the degree of care and planning which has been shown in preparing applications for Public Works Administration assistance. Especially in the non-Federal program (i. e., construction by States and localities aided by grants or loans), projects which were well prepared and planned naturally gained precedence over those which had not been submitted in such good form. Consequently, the acumen and intelligence of the State and local officials concerned have been factors in the choice of projects and have ranked in importance with the merits of the projects themselves. In the Federal program projects have had a better chance of receiving Public Works Administration assistance when they came from Government departments or bureaus with a keen appreciation of their needs and the ability to plan for them. This factor of preparedness, as it operates in the selection of projects, has been favored by the episodic, year-to-year character of the public works programs since 1933. Were the emergency public works policy of the United States given a long-run formulation, preparation would become more general, and the mere fact of a project being ready would be a less important factor in its selection.

The financial or legal competence of the locality has also operated in the selection of the projects in the non-Federal programs. Communities with limited borrowing power or a difficult financial situation have been less able to advance their projects than more favorably situated communities. This factor in the operation of any system of Federal aid to local public works, like that of the Public Works Administration, seems inescapable.

Usefulness or social justifiability of the project has, of course, been a major criterion in Public Works Administration's approvals. It would appear that, given the factor of flexibility and a reasonable degree of completeness in the application and preparation by the applicant, this has been in most cases the determining consideration in choosing projects. The Public Works Administration has had certain standards of usefulness according to which it has selected projects, and in the later programs Congress outlined the broad apportionment of funds to various uses. In the non-Federal program it was largely its appraisal of usefulness which led Public Works Administration to emphasize sewage-disposal projects and water-supply projects more than streets and roads.[7] For this reason, recreational developments have not ranked so high as educational structures or hospital buildings. To determine the comparative usefulness of different classes of projects is, of course, a difficult and, in some part, an arbitrary matter; the important point for the present purposes is that this determination is not only necessary but extremely important.[8]

The relation of the proposed projects to the regional distribution of unemployment has also been a factor in the selection of different classes and locations of projects. In the non-Federal program, the Public Works Administration has set up State allotments in accordance with a formula which combines State population with unemployment. Except as a matter of political equity, it should be noted, population is not a decisive criterion. Were usefulness of the projects the sole matter of concern, then areas of the country which are deficient in essential works could properly press their claim over areas of greater population but better equipment. A strong effort was made also in selecting Federal projects for allotment to give the work some regional distribution; the difficulties here have not always been recognized in discussions of public works in the past. In the nature of the case it will always be a difficult matter to locate Federal construction projects in accordance with unemployment. The demand for Federal works tends to some concentration in the District of Columbia, at army posts and naval yards, and in the national park, national forest, and public-domain States. These are not areas, in general, of heavy population or of the most serious unemployment. Useful projects in areas of heavy Federal activity, but of relatively low unemployment, have been refused allotment by the Public Works Administration for this reason. A similar situation will almost certainly hold in future programs.

The employment yielded by the projects under consideration has also been considered when there was an opportunity to exercise a free choice over a considerable range of projects. In connection with non-Federal projects, local authorities were required to submit estimates of the quantity and character of the employment to be offered by the construction of the project, and these were a factor in the selection. Even apart from these estimates, which in many cases were probably optimistic and somewhat erratic, types of works construction with a low employment efficiency tended to be ruled out. Thus, projects for re-equipping existing structures or which involved heavy purchases of elaborate machinery and equipment have played a small part in Public Works Administration activities. It is possible that these were eliminated in part because they were considered outside the definition of public works, but the effect at the same time was to eliminate classes of projects where the amount of employment per unit of expenditures was probably small.

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[7] A further consideration was that streets and roads were more likely to be provided for from other sources.

[8] In the non-Federal program a further problem of Federal versus State and local determination of "need" arises. States and localities have jurisdiction to the extent that they apply for the works of which they are in greatest need. However, considerable power has rested with the Public Works Administration because of its ability to choose between different localities offering different kinds of projects.

Apart from a general consideration of the relative needs of common labor and the skilled trades, comparatively little attention has been given by the Public Works Administration to the adjustment of the labor requirements of construction projects to special skills available among the unemployed; and likewise, little or no effort has been made to adjust construction material and equipment requirements to the situation in industries supplying these items. It is probable, as suggested, that little more can or need be done in this respect in the future.

In connection with non-Federal projects, the investment-inducing quality of different classes of public improvements has not been a major factor in the selection, although it probably had some effect.[9] In the Federal program, certain projects have been favored because of the investment or employment which promised to follow in their wake; certain reclamation projects, or projects for the regeneration of past reclamation activities, have received favorable consideration for this reason.

TABLE 1.—*Estimated expenditures for various types of PWA Federal, PWA non-Federal, and regular Federal construction projects, including funds from non-Federal sources, 1933–38*

Project type	PWA Federal [1]		PWA Non-Federal [1]		Regular Federal [2]		Federal-aid highways (dollars in millions)
	Dollars in millions	Percent	Dollars in millions	Percent	Dollars in millions	Percent	
Streets and roads	[3] 464	27.4	232	9.0	32	1.8	[4] 1,928
Sewer and water systems	6	.4	545	21.1	4	.2	--------
Vessels	266	15.7	--------	--------	[5] 725	40.3	--------
Nonresidential building	212	12.5	1,059	41.1	268	14.9	--------
Residential building	104	6.1	12	.5			
Flood control, water power and reclamation	234	13.8	89	3.5	664	[6] 36.9	--------
Electric power excluding water power	5	.3	28	1.1	76	[6] 4.2	--------
All others	402	23.8	613	23.7	31	1.7	--------
Total	[3] 1,693	100.0	2,578	100.00	1,800	100.0	1,928

[1] Reported project costs as of Dec. 31, 1938, according to records of Projects and Statistics Division of the Public Works Administration. The non-Federal total includes about $1,676 millions of State and local funds.

[2] Regular Federal expenditures (excluding Federal-aid highways which are shown separately) were estimated by applying payrolls and material orders percentages of total costs on various types of PWA projects to the recorded amounts of regular Federal pay rolls and material orders. These amounts as reported by the Bureau of Labor Statistics cover only contracts awarded after July 1, 1934, but the estimates were adjusted to cover the entire period, 1933–38.

[3] Includes $456 million spent for Federal-aid highways and included above under Federal-aid highways.

[4] Includes $1,525 million of Federal funds and an estimated $403 million of State funds involved as stated in a special tabulation prepared by the Public Roads Administration. The entire period 1933–38 is covered.

[5] Includes naval and "other."

[6] There may be some overlapping of amounts allocable to water-power development since the regular Federal breakdown is (1) "Reclamation, locks and dams, dredging, dikes, and revetments" which have been grouped with the Public Works Administration classification "Flood control, water power, and reclamation" and (2) "Electrification" which has been grouped with Public Works Administration "electric power" projects.

The Project Composition of Federal and Federally Aided Public Works Programs

From 1933 through 1938 the estimated expenditures on PWA Federal projects totalled $1,693,000,000, and on PWA non-Federal projects $2,578,000,000 (including funds of States and localities). The total expenditures on projects financed from regular Federal appropria-

TABLE 2.—*Federal projects and Federal low-cost housing projects, showing allotments [1] and reported value of work done, as of December 31, 1938—NIRA and PWAA 1938 programs.*

[Distributed by type of project]

Type of project	Number of projects	Allotments	Value of work done [2]
Educational buildings	207	$20,954,889	$14,594,577
Hospitals and institutions for medical treatment	152	36,795,147	18,849,272
Public buildings	2,821	246,383,388	178,945,511
Sewer systems	128	4,003,650	3,627,898
Water systems	164	3,489,375	2,493,536
Electric power, excluding water power	92	15,516,977	4,786,718
Streets and highways	9,927	466,244,715	[3] 464,084,413
Engineering structures	181	23,021,813	17,844,127
Flood control, water power and reclamation	338	263,250,544	233,783,385
Federal low-cost housing [4]	51	[5] 136,669,759	104,407,950
Vessels	259	270,640,473	265,675,301
All others	3,543	416,712,671	383,875,970
Total	17,863	1,903,683,411	1,692,968,658

[1] Allotments made available under authority of the Fourth Deficiency Act, fiscal year 1933 (Public, No. 77, 73d Cong.), and the Emergency Appropriation Act, fiscal year 1935 (Public, No. 412, 73d Cong.), and the Public Works Administration Appropriation Act of 1938.

[2] Subject to revision. Technically this is entitled "reported project costs," by PWA. "Value of work done" represents the cost of materials in place (including the cost of labor performed) and miscellaneous costs, for that portion of the work completed.

[3] Includes $455,850,924 spent for Federal-aid highways.

[4] Figure as of Nov. 1, 1937, the date on which these projects were transferred to the U. S. Housing Authority.

[5] Of this amount $107,085,289 was made available under authority of the Emergency Relief Appropriation Act of 1935 (Public Res. No. 11, 74th Cong.).

Source: Federal Emergency Administration of Public Works, Projects and Statistics Division.

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[9] In an early declaration of policy, *The Purposes, Policies, Functioning and Organization of the Emergency Administration*, Circular 1, July 31, 1933, p. 8, this appears as one of the criteria in the selection of projects in the following paragraph:

"The following classes of projects will be preferred as to the grant: (1) Waterworks projects not unduly burdening the community with debt and necessary for its health and convenience; (2) sewer projects of the same character; (3) sewage-disposal projects sufficiently comprehensive to render a river or lake system, used by many communities, safe as a water supply, and other sewage-disposal projects; (4) other projects, which, like the foregoing, are regenerative, i. e., tend to stimulate further projects, such as highways, bridges, and tunnels, opening of new territory for homes and industry, projects for the transmission of electrical energy into territories not now served."

tions, excluding Federal-aid highways, are estimated at $1,800,000,000. Total expenditures on Federal-aid highway projects, including State funds, were $1,928,000,000. The following tables show the major types of projects which have been launched during this period and the expenditures on, or estimated costs of, projects in the various classes.

The different character of a Federal as contrasted with a non-Federal program is brought out by table 1. Nonresidential buildings, for example, comprised 41 percent of the PWA non-Federal programs, compared with only 12.5 percent of the PWA Federal programs and approximately 15 percent of regular Federal construction. Similarly, sewer and water projects made

TABLE 3.—*Non-Federal projects, showing allotments [1] and value of work done, as of Dec. 31, 1938—NIRA, ERA 1935, ERA 1935 supplemental, FDA 1936, PWAE 1937, and PWAA 1938 programs*

[Distributed by type of project]

Type of project	Number of projects	Total estimated cost	Allotment			Value of work done [2]
			Total	Loan	Grant	
Educational buildings	7, 290	$1, 160, 495, 541	$573, 337, 610	$93, 916, 383	$479, 421, 227	$706, 061. 277
Hospitals and institutions for medical treatment	671	299, 618, 741	137, 094, 381	21, 849, 546	115, 244, 835	172, 626, 631
Public buildings	1, 485	313, 136, 332	142, 086, 645	17, 762, 356	124, 324, 289	180, 808, 103
Sewer systems	1, 725	490, 293, 105	295, 992, 161	117, 296, 102	178, 696, 059	349, 007, 817
Water systems	2, 421	312, 571, 324	170, 591, 106	55, 528, 487	115, 062, 619	196, 492, 775
Electric power, excluding water power	288	97, 626, 148	62, 387, 902	24, 017, 200	38, 370, 702	27, 544, 086
Streets and highways	1, 500	454, 861, 741	199, 775, 244	17, 447, 775	182, 327, 469	232, 125, 544
Engineering structures	475	463, 377, 043	270, 780, 155	136, 009, 957	134, 770, 198	277, 310, 976
Flood control, water power, and reclamation	131	194, 905, 876	175, 469, 561	103, 764, 711	71, 704, 850	89, 481, 768
Limited dividend housing [3]	7	11, 760, 399	10, 403, 391	10, 403, 391		11, 760, 399
Railroads	32	200, 974, 500	200, 974, 500	200, 974, 500		200, 974, 500
All others	684	185, 371, 286	98, 462, 178	30, 644, 355	67, 817, 823	133, 985, 624
Total	16, 709	4, 185, 002, 036	2, 337, 354, 834	829, 614, 763	1, 507, 740, 071	2, 578, 179, 500

[1] Allotments made available under authority of the Fourth Deficiency Act, fiscal year 1933 (Public, No. 77, 73d Cong.), the Emergency Appropriation Act, fiscal year 1935 (Public, No. 412, 73d Cong.), the Emergency Relief Appropriation Act of 1935 (Public Res. No. 11, 74th Cong.), the First Deficiency Appropriation Act, fiscal year 1936, the Public Works Administration Extension Act of 1937, and the Public Works Administration Appropriation Act of 1938.

[2] Subject to revision. Technically this is entitled, "reported project costs," by PWA. "Value of work done" represents the cost of materials in place (including the cost of labor performed) and miscellaneous costs, for that portion of the work completed.

[3] Figures as of Nov. 1, 1937, the date on which these projects were transferred to the U. S. Housing Authority.

Source: Federal Emergency Administration of Public Works, Projects and Statistics Division.

TABLE 4.—*Non-Federal projects, Federal projects, and Federal low-cost housing projects, showing allotments [1] and value of work done, as of Dec. 31, 1938—NIRA, ERA 1935, ERA 1935 supplemental, FDA 1936, PWAE 1937, and PWAA 1938 programs*

[Distributed by type of project]

Type of project	Number of projects	Total estimated cost	Allotment			Value of work done [2]
			Total	Loan	Grant [1]	
Educational buildings	7, 497	$1, 181, 450, 430	$594, 292, 499	$93, 916, 383	$500, 376, 116	$720, 655, 854
Hospitals and institutions for medical treatment	823	336, 413, 888	173, 889, 528	21, 849, 546	152, 039, 982	191, 475, 903
Public buildings	4, 306	559, 529, 720	388, 470, 033	17, 762, 356	370, 707, 677	359, 753, 614
Sewer systems	1, 853	491, 296, 755	299, 995, 811	117, 296, 102	182, 699, 709	352, 635, 715
Water systems	2, 585	316, 060, 699	174, 080, 481	55, 528, 487	118, 551, 994	198, 986, 311
Electric power, excluding water power	380	113, 143, 125	77, 904, 879	24, 017, 200	53, 887, 679	32, 330, 804
Streets and highways	11, 427	921, 106, 456	666, 019, 959	17, 447, 775	648, 572, 184	[3] 696, 209, 957
Engineering structures	656	486, 398, 856	293, 801, 968	136, 009, 957	157, 792, 011	295, 155, 103
Flood control, water power, and reclamation	469	458, 156, 430	438, 720, 115	103, 764, 711	334, 955, 404	323, 265, 153
Limited dividend housing [4]	7	11, 760, 399	10, 403, 391	10, 403, 391		11, 760, 399
Federal low-cost housing [4]	51	136, 669, 759	136, 669, 759		136, 669, 759	104, 407, 950
Railroads	32	200, 974, 500	200, 974, 500	200, 974, 500		200, 974, 500
Vessels	259	270, 640, 473	270, 640, 473		270, 640, 473	265, 675, 301
All others	4, 227	602, 083, 957	515, 174, 849	30, 644, 355	484, 530, 494	517, 861, 594
Total	34, 572	6, 088, 685, 447	4, 241, 038, 245	829, 614, 763	3, 411, 423, 482	4, 271, 148, 158

[1] Includes allotments to Federal agencies. Allotments made available under authority of the Fourth Deficiency Act, fiscal year 1933 (Public, No. 77, 73d Cong.), the Emergency Appropriation Act, fiscal year 1935 (Public, No. 412, 73d Cong.), the Emergency Relief Appropriation Act of 1935 (Public Resolution No. 11, 74th Cong.), the First Deficiency Appropriation Act, fiscal year 1936, the Public Works Administration Extension Act of 1937, and the Public Works Administration Appropriation Act of 1938.

[2] Subject to revision. Technically this is entitled "reported project costs," by PWA. "Value of work done" represents the cost of materials in place (including the cost of labor performed) and miscellaneous costs, for that portion of the work completed.

[3] Includes $455,850,924 spent for Federal-aid highways.

[4] Figures as of Nov. 1, 1937, the date on which these projects were transferred to the U. S. Housing Authority.

Source: Federal Emergency Administration of Public Works, Projects and Statistics Division.

up 21 percent of the non-Federal programs and less than half of one percent of the Federal programs. On the other hand, naval vessels and power and reclamation projects together constituted 77 percent of regular Federal construction and 30 percent of PWA Federal construction, whereas only 3.5 percent of the non-Federal PWA projects were classified as power and reclamation projects, and no vessels were built under this program.

The types of projects available for a Federal program are limited by current definitions of the sphere of Federal activity. Buildings must necessarily be in large part post offices for which there is a limited need. On the other hand, the opportunities for reclamation and power projects, highway improvement, and naval vessels are abundant. The composition of the non-Federal programs depends on the needs and financial ability of the locality and on what the local authorities want to build. The discretionary power of the Federal supervisory agency in the composition of the program consists largely in its ability to choose between applicants.

History of Public Works Administration Appropriations

While this study is concerned with all public works activities of the Federal Government, it may be helpful to review briefly the history of emergency public works appropriations in the period 1933–38. [10] Funds for the Public Works Administration, which was established under title II of the National Industrial Recovery Act, were provided by the Fourth Deficiency Act, approved June 16, 1933. Of the $3,300,000,000 appropriated under this act, various sums were deducted for impoundments, allotments, transfers to other agencies and administrative expenses. The net funds remaining available to PWA for allocation were as follows: For PWA non-Federal projects, $403,988,059; railroad projects, $182,740,500; for administrative expenses, $75,611,889, making a total of $662,340,448. For PWA Federal projects the sum of $1,317,882,529 was available. However, other statutory allotments under the supervision of the Federal Projects Division of PWA were made from funds included in the above $1,317,882,529: For Federal-aid highways, $400,000,000; for forest highways, roads and trails, and national parks roads and trails, $50,000,000; plus a net diversion of $15,000,000 for subsistence homesteads. The sum of $238,000,000 for the construction of naval vessels was transferred to the Navy Department by the President.

The Emergency Appropriation Act, approved June 19, 1934, provided $394,000,000 of additional funds for PWA. Of this amount, $26,469,701 was impounded and transferred, leaving $118,398,383 for PWA non-Federal projects, and $249,131,916 for PWA Federal projects.

Under the Emergency Relief Appropriation Act of 1935, approved April 8, 1935, $495,389,125 was provided. Of this sum, $313,339,438 was made available to PWA for non-Federal projects after $74,179,398 was impounded and transferred, and an additional $107,870,289 was allotted for housing projects which were later transferred to the United States Housing Authority and the Puerto Rico Reconstruction Administration.

The Emergency Appropriation Act of 1935 created a revolving fund which authorized the Reconstruction Finance Corporation to purchase securities from PWA which could in turn use the proceeds thereof for making additional loans for non-Federal public works projects. The amount invested by the RFC in such securities was not to exceed $250,000,000 at any time.

The revolving fund was increased in the Emergency Relief Appropriation Act of 1935 whereby the President, who transferred this authority to the PWA Administrator, was authorized to sell on the open market, as well as to RFC, any bonds purchased by PWA and to use the proceeds for loans. The amounts received totaled $591,698,354. This sum was distributed in the following way: $274,191,993 to PWA non-Federal projects; $18,234,000 to railroad projects; $9,000,000 to administrative expenses (for the fiscal year 1939); and $290,272,361 was transferred under the terms of the First Deficiency Appropriation Act of 1936 which authorized the Administrator to make grant allotments not to exceed $300,000,000 from funds on hand (in the revolving fund). This $290,272,361 was then divided in the following way: $275,272,361 was made available for PWA non-Federal projects, and $15,000,000 was allocated for administrative expenses in the fiscal year 1938. Under the Public Works Extension Act of 1937, the Reconstruction Finance Corporation was authorized to acquire securities not to exceed $400,000,000 at any one time, and the PWA was authorized to increase the amount of grants from the revolving fund from $300,000,000 (authorized under the First Deficiency Appropriation Act of 1936) to $359,000,000.

The Public Works Administration Appropriation Act of 1938 provided an appropriation of $965,000,000 for public works. PWA non-Federal projects received $724,000,000, PWA Federal projects $200,000,000, while of the remainder, $6,000,000 was deducted to purchase land for new Federal administration buildings, and the rest was reserved for administrative expenses for the fiscal years 1939 and 1940.

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[10] Source: *Justification for Appropriations Fiscal Year Ending June 30, 1940*, issued by Federal Emergency Administration of Public Works; *Status of the Appropriation*, compiled by the Economics and Statistics Division of the Public Works Administration, May 1935; *America Builds*, issued by the Public Works Administration, 1939, pp. 36, 37.

In these first two chapters an attempt has been made to sketch briefly and in broad outline some of the economic aspects of public works construction activity geared to the problem of national unemployment: The determination of the level of expenditure, the relationship to the volume of unemployment, financial methods and implications, and the criteria for selecting specific projects. In the remaining chapters we turn to an analysis of the experience of the Federal Government with public works during the 6 years 1933 to 1938.

CHAPTER III—FEDERALLY FINANCED CONSTRUCTION IN RELATION TO TOTAL CONSTRUCTION AND TO BUSINESS ACTIVITY IN RELATED INDUSTRIES

The task of the present chapter is to relate the volume of federally financed construction in recent years to the level of activity in the construction industry as a whole and to trace this influence back to the industries producing for public works orders. Specific consideration of the level of employment on public works construction and in the material supply industries is reserved for the next chapter; the effect of public works construction on prices and costs, and through these on private construction, is taken up in the chapter following. All three chapters are, however, complementary approaches to the central problem of the study, namely, the determination of the relation of Federal expenditures for construction to the nature and levels of economic activity during 1933–38.

In this chapter we are interested, as in the case also of the next one on employment, only in the identifiable effects of such expenditures. The secondary effects are not subject to statistical treatment with data now available, and they are discussed qualitatively in appendix B.

"Federal public works expenditures," as a category, comprises several different administrative sources of public works activity. In the first place, there is ordinary Federal construction undertaken as in the past by numerous departments and agencies and financed from regular appropriations. Secondly, there is direct construction by Federal agencies and departments financed by Public Works Administration funds. In the third place, there are Public Works Administration grants for non-Federal construction of various types, and regular Federal grants to States and localities for highway construction. Fourthly, there are work-relief expenditures under the works program, primarily under the jurisdiction of the Works Progress Administration. Finally, the Public Works Administration, Reconstruction Finance Corporation, and United States Housing Authority have made loans to both public and private entities for construction projects. In this chapter, two classifications (based on the nature of available data) of Federal expenditure are used. For the most part the category, Federal expenditure, will include only direct expenditures plus grants to States and localities; construction expenditures financed by Federal loans will be attributed to the borrowing State, locality or private enterprise, and, consequently, the total scope of Federal financing will be somewhat understated. Work relief construction will be maintained as a separate category. In the sections treating the effect of material orders on construction-supply industries, however, the classification "construction financed wholly or partially from Federal funds" will be used;[1] this includes the total expenditure for all Federal-aid highway projects, PWA non-Federal projects, and RFC projects, whether the financial aid takes the form of a loan or grant. In addition, this second classification includes shipbuilding and railroad equipment projects, whereas the former does not.

The effects of public works construction expenditures on money income are measured, as with employment, by the direct payments to labor at the site of construction, and by the payments for services and for materials which are already, in most cases, in an advanced state of production. Whereas the real income of the community in any one period can be stated in terms of goods and services actually consumed, quite apart from the production occurring in stages previous to final consumption, nevertheless in an industrial community the level of real income is very largely determined by the level of activity in the earlier stages of production, that is, primarily in producers' goods industries.

The above observation explains the peculiar importance of construction activity to movements in the national income. It is the principal durable goods industry and, therefore, represents a foremost avenue for the real investment necessary to maintain income and employment and to absorb savings. The average annual expenditures for new construction during the period 1920 to 1930 have been estimated at $9,000,000,000; from 1925 to 1929 they averaged somewhat higher, about $10,600,000,000 annually.[2] Construction during that period accounted for a large proportion of the total production of durable goods, and it was a principal means by which the high level of current savings was converted into actual investment.

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[1] The Bureau of Labor Statistics maintains records of the volume and type of material orders placed for all projects financed in whole or in part from Federal funds. In the case of those projects financed jointly by the Federal and State or local governments, any distribution of the cost of materials between the two financing parties has no significance.

[2] The dollar volume of public works expenditures is used in this report for several purposes: To indicate the number of dollars actually spent for public works construction; to compare the volumes of construction undertaken at any time under different auspices or by different units of Government; and to compare the volume of construction at different periods. Where expenditure figures are used to indicate and compare the volume of construction under different circumstances or at different periods of time, the result is an approximation. Levels of cost vary between different parts of the country and especially from one period to another. While these variations are not great enough to affect the conclusions which one reaches in using dollar figures, they should be kept in mind.

The low level of new construction activity since 1930 has been in sharp contrast with that of the previous decade. From 1933 to 1938 the average annual value of new construction, excluding work relief construction, was $3,800,000,000 or only 36 percent of the predepression level. The comparative failure of construction activity to respond to the forces of recovery can be cited as a principal reason for the failure of total employment and real income to reach the predepression level.

Relation of Public Construction to Total Construction

The construction of public works has been, in modern times at least, a substantial element in construction activity. During the 1920's the proportion of public works to total construction averaged 22 percent. The works consisted mainly of highways and various public service enterprises built by State and local governments and financed by them from taxation or bond issues. The volume of these works bore no planned relation to general economic or cyclical movements. During this period, however, the idea was gaining ground that public works construction should be utilized as an instrument for combating cyclical fluctuations in private activity. As the depression following 1929 deepened, the Federal Government embarked on various programs of public works expenditure as one method of helping to maintain the level of income and employment. There has been, as a result, a sharp shift in the relationship of public works construction to the total of construction activity, and there have been important changes in the methods by which public works construction is financed.

Unfortunately, there are no direct measurements of the volume of construction activity, either by private enterprise, by State and local governments, or even by the Federal Government. Consequently, it is necessary to make use of estimates. Both the Bureau of Foreign and Domestic Commerce in the Department of Commerce, and the Division of Research, Statistics, and Records of the Works Progress Administration compile current estimates, but the two series (owing to differences of definitions, sources, and assumptions) show substantial variations in every category. In this study the Department of Commerce estimates will be employed, except in the case of work relief construction where the WPA estimates will be used. It should be noted that in all categories, including WPA, expenditures for current maintenance construction are excluded as far as possible.

The estimated volume of new construction activity in the predepression and postdepression periods is shown in table 1, broken down by public, private, and work relief construction. It should be noted again that the private classification includes expenditures by private enterprises financed by Federal loans, and the Federal classification excludes the construction of naval vessels and railroad equipment. Three important observations may be made on the course of construction activity over the 14-year period. In the first place, the volume of public works expenditures not only failed to operate in a countercyclical or stabilizing manner during the critical years 1931 to 1933, but on the contrary, it substantially aggravated the drastic decline in the total of construction activity which resulted from the near-disappearance of private building operations. The annual expenditure for public works construction, excluding work relief, fell from $2,300,000,000 in 1925–29 and $2,800,000,000 in 1930, to $1,200,000,000 in 1933, and in no subsequent year has it exceeded approximately $2,000,000,000. It is to be noted, however, that public works construction declined much less than private construction did; by 1933 it had fallen 47 percent from the 1925–29 average, as compared with a decline of 87 percent in private construction.

Because the volume of public works construction dropped off much less than did private activity, the proportion of total construction which public works constituted rose sharply. Public works accounted for

TABLE 1.—*Estimated expenditures for new construction in the United States, by sources of funds, 1925–38*

[In millions of dollars]

Year	Public, excluding work relief[1]	Private	Total new construction, excluding work relief	Work relief	Public, including work relief	Total, including work relief	Public, as percent of total, excluding work relief	Public, as percent of total, including work relief
Average 1925–29	2,292	8,341	10,633	------	------	------	21.6	------
1930	2,777	5,941	8,718	------	------	------	31.9	------
1931	2,577	3,712	6,289	------	------	------	41.0	------
1932	1,794	1,767	3,561	------	------	------	50.4	------
1933	1,216	1,091	2,307	138	1,354	2,445	52.7	55.4
1934	1,459	1,232	2,691	715	2,174	3,406	54.2	63.8
1935	1,403	1,605	3,008	447	1,850	3,455	46.6	53.5
1936	1,994	2,551	4,545	1,222	3,216	5,767	43.9	55.8
1937	1,894	3,326	5,220	994	2,888	6,214	36.3	46.5
1938	2,022	3,107	5,129	1,206	3,228	6,335	39.4	51.0
Average 1933–38	1,665	2,152	3,817	787	2,452	4,604	43.6	53.3

[1] Excludes Federal loans to private enterprises, and shipbuilding and railroad equipment projects.

Source: Department of Commerce, *Construction Activity in the United States, 1915-37*, and "Recent Developments in Construction Activity," *Survey of Current Business*, August 1939, for all categories except work relief construction which was taken from Peter A. Stone, *Construction Expenditures and Employment*, Works Progress Administration. The Commerce estimates of public construction include a part of work relief expenditures as a result of their methods of compilation; these amounts, as estimated by them, have been deducted from public construction excluding work relief.

The Department of Commerce, in a revision too late to be employed in this study, decreased its estimate of private construction in 1938 from $3,107 millions to $2,932 millions.

22 percent of the total from 1925–29 and rose to 53 percent in 1933. The ensuing recovery in total new construction from $2,307,000,000 in 1933 to around $5,200,000,000 in 1937 and 1938 did not involve a significant decline in this percentage. In but 2 of the 6 years up through 1938 did public construction comprise less than 40 percent of the total volume, and the average proportion for the entire period was 44 percent.

Work relief expenditures for construction in this period ranged from $138,000,000 in 1933 to $1,222,000,000 in 1936. If they are included in the total, the volume of construction in 1938 reached $6,335,000,000, about 60 percent of the 1925–29 average. The proportion which public construction represented of the total was 53 percent from 1933–38.

Table 1 clearly indicates that the reason for such recovery in construction as has occurred is accounted for in large part by the increase in public expenditures for construction to a level substantially in excess of the predepression volume. Private construction has increased also, and if 1933 is taken as the base year, the rise appears very large (over 200 percent in 1937); but taking the 1925–29 level as a base, the increase was from only 13 percent in 1933 to 40 percent in 1937 and to 37 percent in 1938. This contrasts with a similar increase in public expenditures for construction, including work-relief construction, from 59 percent of the predepression level in 1933 to 126 percent in 1937 and to 141 percent in 1938. Excluding work relief, the rise in public construction was from 53 percent of the 1925–29 level in 1933 to 88 percent in 1938.

TABLE 2.—*Estimated expenditures for new public construction, by sources of funds,*[1] *1925–38*

[Dollar figures in millions]

Year	Excluding work relief						Including work relief			
	Federal direct	PWA grants and Federal aid for highways	Total Federal	State and local	Federal as percent of total public	Federal as percent of all construction	Work relief	Federal including work relief	Federal as percent of total public	Federal as percent of all construction
Average, 1925–29	103	85	188	2,104	8.2	1.8	-----	-----	-----	-----
1930	190	117	307	2,469	11.1	3.5	-----	-----	-----	-----
1931	250	172	422	2,156	16.4	6.7	-----	-----	-----	-----
1932	283	177	460	1,334	25.6	12.9	-----	-----	-----	-----
1933	312	197	509	707	41.9	22.1	138	647	47.8	26.5
1934	368	297	665	794	45.6	24.7	715	1,380	63.5	40.5
1935	427	360	787	616	56.1	26.2	447	1,234	66.7	35.7
1936	501	612	1,113	881	55.8	24.6	1,222	2,335	72.6	40.5
1937	524	525	1,049	845	55.4	20.1	994	2,043	70.7	32.9
1938	518	415	933	1,089	46.1	18.2	1,206	2,139	66.3	33.8
Average, 1933–38	442	401	843	822	50.6	22.1	787	1,630	66.5	35.4

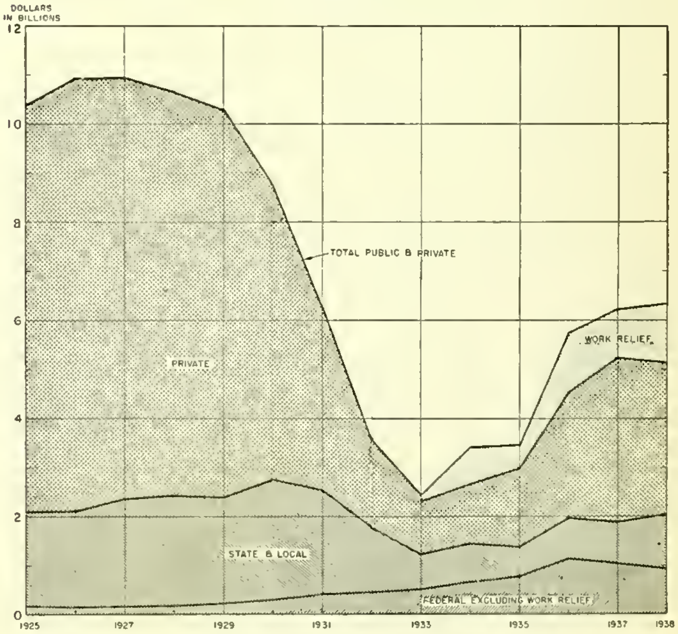
[1] Federal expenditures include grants, but exclude loans to States, localities, and private business.

Source: Department of Commerce, except estimates of work relief construction which are those compiled by the Works Progress Administration. The Commerce estimates of Federal construction include some work relief construction expenditures as a result of their methods of compilation; these amounts, as estimated by them have been deducted from the Federal (excluding work relief) figures.

Public construction, in addition to becoming a vastly more important component of total construction, has, as might be expected, shown a marked change in its auspices. Federal expenditures have increased strongly in relation to expenditures by States and localities. Table 2 presents a comparison of the volumes of Federal, and State and local expenditures. It will be noted that from 1925–29 Federal expenditure for construction, including grants but excluding loans, averaged 8 percent of the total expenditures for public construction and 2 percent of all construction expenditures, whereas in 1933 to 1938, it averaged, excluding work relief, 51 percent of the total public construction expenditures and 22 percent of all construction expenditures. Including work relief, it averaged 67 percent of total public expenditures for construction and 35 percent of all construction expenditures. In terms of volume, the increase in Federal expenditure was from an average of $188,000,000 in 1925–29 to $843,000,000 in 1933–38, excluding work relief, and to $1,630,000,000, including work relief. Consequently, not only has the recovery in construction activity been largely accounted for by the increase in public expenditures, but that increase, in turn, has been largely an increase in the use of Federal money. In fact, a major share of the increase in

FIG I

ESTIMATED EXPENDITURES FOR NEW CONSTRUCTION AND WORK RELIEF CONSTRUCTION IN THE UNITED STATES 1925-1938



NOTE FEDERAL CONSTRUCTION EXPENDITURES INCLUDE GRANTS BUT EXCLUDE LOANS; ALSO EXCLUDE SHIPBUILDING AND RAILROAD EQUIPMENT PROJECTS

SOURCE SEE TABLES 1 AND 2

Federal expenditures served only to offset the drastic decline in public works expenditures of State and local governments. State and local expenditure averaged $2,104,000,000 from 1925–29, in contrast with only $822,000,000 from 1933–38, a decline of 61 percent. In no year did State and local construction show any significant tendency to recover from the greatly depleted level of 1933. Figures 1 and 2 show the aggregate expenditure on new construction from 1925–38 and the percentages of the total attributable to Federal, State and local, and private spending.

The relative position of the PWA in the picture is indicated by a comparison of the reported costs of the PWA projects with the total expenditure for construction, as given in table 3. (It is important to note that, in the case of non-Federal projects, ordinarily between 55 and 70 percent of the funds were from non-Federal sources.) During 1933–38 PWA projects constituted roughly 18 percent of total construction expenditures, excluding work relief. They reached both their absolute and relative peak in 1934 when they represented 41 percent of the total and declined steadily until 1938 when they represented but 11 percent of the total. Including work relief, in the totals, 15 percent of total construction resulted from PWA projects, the peak being 33 percent in 1934.

The estimated aggregate expenditures on projects financed wholly or partially from Federal funds, exclusive of work relief, are shown in table 4. In order to make the estimates conform to the Department of Commerce figures it was necessary to make certain adjustments, which are explained in the note to table 4, to exclude certain items not considered as construction expenditures by the Department of Commerce. The estimated total expenditures so adjusted amounted to $6.7 billions, of which $5.1 billions represented Federal funds.

TABLE 3.—*PWA project costs* [1] *compared with total expenditures for new construction*

[In millions of dollars]

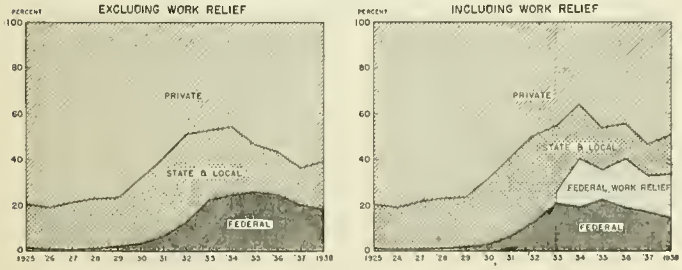
Year	PWA project costs			Total new construction		PWA projects as percent of total	
	Federal	Non-Federal	Total	Excluding work relief	Including work relief	Excluding work relief	Including work relief
1933	105	8	113	2,307	2,445	4.9	4.6
1934	761	352	1,113	2,691	3,406	41.4	32.7
1935	387	419	806	3,008	3,455	26.8	23.3
1936	198	768	966	4,545	5,767	21.3	16.8
1937	71	536	607	5,220	6,214	11.6	9.8
1938	67	495	562	5,129	6,335	11.0	8.9
Total, 1933–38	1,589	2,578	4,167	22,900	27,622	18.2	15.1

[1] Project costs represent the reported cost of materials and labor in place, and miscellaneous costs for that portion of the work completed. The figures are not identical with either costs incurred or disbursements, and are not strictly comparable with the value of total construction over short periods of time. These figures do not include Federal low-cost housing, $104 millions of which are included in some of the following tables. These projects were transferred to USHA in November 1937.

Sources: Total new construction, see table 1, PWA Project Costs, Public Works Administration, Projects and Statistics Division.

FIG 2

ESTIMATED EXPENDITURES FOR NEW CONSTRUCTION AND WORK RELIEF CONSTRUCTION BY SOURCES OF FUNDS, EXPRESSED AS PERCENT OF TOTAL 1925 - 1938



SOURCE: SEE TABLES 1 AND 2

TABLE 4.—*Estimated total expenditures on projects financed wholly or partially from Federal funds, 1933–38, excluding work relief (adjusted to aggregate estimates of Department of Commerce* [1]*)*

[In millions of dollars]

	Federal funds (excluding loans)	State and local funds	Total
PWA:			
Federal	874		874
Non-Federal	902	1,237	2,139
Federal-aid highways	1,525	403	1,928
Regular Federal and Federal projects under works program	1,755		1,755
Grand total	5,056	1,640	6,696

[1] In compiling this table it has been necessary to adjust reported expenditur figures to accord with the Department of Commerce classification. The following adjustments were made:

PWA Federal: Reported project expenditures of $1,693 million as given by PWA were decreased by $266 million, spent on vessels, and $456 million included in the reports of the Public Roads Administration. The remainder was reduced by 10 percent, leaving a net amount of $874 million, an allowance for items not classified as construction expenditures by the Department of Commerce.

PWA non-Federal: $902 million was estimated by the Department of Commerce as the amount of Federal grants for new construction. PWA's statement of reported expenditures on all non-Federal projects, $2,578 million, was diminished by $201 million spent on railroad projects, an allowance of 10 percent of the remainder was made for items not classified as construction cost by the Department of Commerce, and $902 million (Federal grants) was then subtracted, leaving a net amount of $1,237 million as the expenditures from non-Federal funds.

Federal-aid highways: These amounts include both regular and emergency expenditures. Flood relief, national recovery work relief, forest and public lands projects are omitted.

Regular Federal and Federal projects under the works program: Approximately $725 million spent on naval vessels has been excluded.

Summary

The following conclusions can be drawn from the data presented in this section:

1. Construction activity, constituting as it does the principal durable goods industry, has formerly represented an important source of income production, and during the 1920's contributed perhaps the most fundamental stimulus to the high level of income and industrial activity.

2. In the critical years 1931 to 1933, public works activity did not operate as a counterbalance to the drastic decline in private construction, but on the contrary, itself declined by 47 percent from the predepression level. This decline was entirely due to the rapid contraction of State and local expenditures. However, the drop in public works was substantially less than the 87 percent contraction in private activity.

3. Although, in the period 1933 to 1938, total new construction did not approach the predepression volume, nevertheless, including work relief construction, it did increase from $2,400,000,000 in 1933 to $6,300,000,000 in 1938 ($2,300,000,000 to $5,100,000,000 excluding work relief). This increase was marked by a radical shift in the component parts of the total. Public construction in this period represented, including work relief, 53 percent of total activity as compared with 22 percent from 1925 to 1929. Federal expenditures for construction constituted 67 percent of all public expenditures for construction and 35 percent of all expenditures for construction as compared with 8 percent and 2 percent, respectively, in the predepression period.

4. From 1933 to 1938, PWA projects constituted 15 percent of total construction (18 percent excluding work relief), declining from 33 percent in 1934 to 9 percent in 1938. In 1938 PWA started construction on no new projects until the third quarter of the year, and on very few until the fourth quarter.

5. Finally, despite the unprecedented level of Federal expenditures for construction during recent years, total construction expenditures (including work relief) in the best year did not reach even 60 percent of the predepression volume. It is obvious, therefore, that any Federal effort on the scale of those recently made would be unable by itself to supply the existing deficiency in income production of private construction, relative to the 1920's.

This is especially true if Federal expenditures continue to be offset by a persistently low level of State and local expenditures. In the period 1933–38, the reduced volume of the latter, relative to 1929, almost offset the sharp increase in Federal outlays. If work relief is excluded, the deficiency in State and local expenditures more than offset the Federal outlays.

Types of Public and Private Construction

The increased proportion of public works in the total volume of construction has involved a shift in the types of construction activity carried on. Private construction is composed primarily of residential, manufacturing and commercial, and public utility projects. Public construction, on the other hand, is concentrated in highways, public buildings, public service, and conservation projects. While there is some overlapping, as in buildings and housing projects, in large part the field of public works has been quite distinct from that of private construction. Unless, for example, housing and power projects are further and drastically expanded, the shifting proportions of public works and private construction naturally will involve, as they have in the past, shifts in the project type composition of the total volume of construction.

In table 5 and figure 3 the totals of public and private construction are broken down by principal types for the period 1925–29 and the years 1930 to 1938; table 6 and figure 4 show these types as percentages of the total. The categories of private construction are nonfarm residential, nonresidential, farm buildings, and public utilities. Of these, nonfarm residential building has usually been by far the most important. It has also

TABLE 5.—*Estimated expenditures for new construction, by types, according to public ar private auspices, 1925–38*

PRIVATE

[In millions of dollars]

Year	Residential nonfarm	Nonresidential	Farm construction (including repairs)	Public utility construction	Total private
Average 1925–29	4, 170	2, 318	469	1, 384	8, 341
1930	2, 195	1, 867	367	1, 512	5, 941
1931	1, 396	1, 110	259	947	3, 712
1932	641	539	125	462	1, 767
1933	314	357	175	245	1, 091
1934	272	453	200	307	1, 232
1935	533	450	284	338	1, 605
1936	1, 101	658	328	464	2, 551
1937	1, 393	933	360	640	3, 326
1938	1, 509	762	336	500	3, 107
Average 1933–38	854	602	281	416	2, 152

PUBLIC

Year	Highways	Nonresidential building	Residential	Conservation and development (Federal)	Public service[1]	All other[2]	Work relief	Total public
Average 1925–29	1, 161	610	------	71	432	18	------	2, 292
1930	1, 481	647	------	111	500	38	------	2, 777
1931	1, 323	591	------	135	479	49	------	2, 577
1932	916	408	------	139	291	40	------	1, 794
1933	675	191	------	168	142	40	138	1, 354
1934	821	180	1	245	157	55	715	2, 174
1935	611	235	9	311	192	45	447	1, 850
1936	807	481	61	310	299	36	1, 222	3, 216
1937	794	412	93	286	262	47	994	2, 888
1938	841	506	32	293	266	84	1, 206	3, 228
Average 1933–38	758	334	33	269	220	51	787	2, 452

[1] Includes sewage disposal and water supply.

[2] Excludes naval vessels and railroad equipment but includes military construction by War and Navy Departments.

Source: Department of Commerce, except work relief construction, for which WPA estimates were used. The Commerce estimates of public construction include some work relief funds; these, as estimated by the Department of Commerce, have been deducted proportionately from the various categories.

TABLE 6.—*Estimated expenditures for new construction, by types, expressed as percent of total public or private construction 1925–38*

PRIVATE

[Percent of total private construction]

Year	Residential nonfarm	Nonresidential	Farm construction, including repairs	Public utility
Average, 1925–29	50.0	27.8	5.6	16.6
1930	36.9	31.4	6.2	25.5
1931	37.6	29.9	7.0	25.5
1932	36.3	30.5	7.1	26.1
1933	28.8	32.7	16.0	22.5
1934	22.1	36.8	16.2	24.9
1935	33.2	28.0	17.7	21.1
1936	43.1	25.8	12.9	18.2
1937	41.9	28.1	10.8	19.2
1938	48.6	24.5	10.8	16.1
Average, 1933–38	39.7	28.0	13.1	19.3

PUBLIC

[Percent of total public construction, including work relief]

Year	Highways	Nonresidential building	Residential building	Conservation and development (Federal)	Public service [1]	All other [2]	Work relief
Average, 1925–29	50.7	26.6	--------	3.1	18.8	0.8	------
1930	53.3	23.3	--------	4.0	18.0	1.4	------
1931	51.3	22.9	--------	5.2	18.6	1.9	------
1932	51.1	22.7	--------	7.7	16.2	2.2	------
1933	49.9	14.1	--------	12.4	10.5	3.0	10.2
1934	37.9	8.3	0	11.3	7.3	2.5	33.0
1935	33.0	12.7	.5	16.8	10.4	2.4	24.2
1936	25.1	14.9	1.9	9.6	9.3	1.1	38.0
1937	27.5	14.3	3.2	9.9	8.1	1.6	34.4
1938	26.0	15.7	1.0	9.1	8.2	2.6	37.4
Average, 1933–38	30.9	13.6	1.3	11.0	9.0	2.1	32.1

[1] Includes sewage disposal and water supply.

[2] Excludes naval vessels and railroad equipment.

fluctuated the most, showing a decline from an average of $4,170,000,000 in 1925–29 to $272,000,000 in 1934; thereafter, it increased to $1,509,000,000 in 1938. The average for the 6 years 1933–38 was $854,000,000, a decline of 80 percent from the predepression period. The next largest category of private construction in 1925–29 was nonresidential building, with an average volume of $2,318,000,000. By 1933 this was reduced to $357,000,000, and the average for 1933–38 was $602,000,000, a decrease of 74 percent from 1925–29. Public utility construction averaged $1,384,000,000 in 1925–29 and $416,000,000 in 1933–38, a drop of 70 percent, the low point being $245,000,000 in 1933. Farm construction declined from $469,000,000 in 1925–29 to $125,000,000 in 1932; it averaged $281,000,000 in 1933–38, a decline from 1925–29 of 40 percent. Of the four types of private construction, farm construction held up much better during 1933–38 than the others, the average for the 6 years being 60 percent of the predepression level, as compared with 20 percent for nonfarm residential, 26 percent for nonresidential, and 30 percent for public utility construction. It should be noted, however, that the farm construction estimates include expenditures for repairs.

The relative position of the four types of private construction has not shown much change except in the case of farm and, to a lesser extent, residential construction. In 1925–29 residential construction constituted 50 percent of the total; in 1933–38, 40 percent. For nonresidential building the percentages were 27.8 percent and 28.0 percent, respectively; for public utilities, 16.6 percent and 19.3 percent. The proportion of farm construction, however, because of the smaller decline in absolute amount, rose from 5.6 percent to 13.1 percent. Moreover, by 1938, residential, nonresidential, and public utility construction had recovered only about 35 percent of their predepression average, whereas farm construction stood at 72 percent of its former value.

With respect to public works, the largest category has consistently been highway and street construction. This averaged $1,161,000,000 in 1925–29, reached a peak of $1,481,000,000 in 1930, declined to $611,000,000 in 1935, and in 1938 amounted to $841,000,000. The average for 1933–38 was $758,000,000, a decline of 35 percent from 1925–29. However, work relief construction, a large part of which was highway work, is not included in these figures. The next largest component of public works is nonresidential building. This averaged $610,000,000 in 1925–29 and $334,000,000 in 1933–38, a drop of 45 percent. The range in the later period was from $180,000,000 in 1934 to $506,000,000 in 1938. Public services, such as water supply and sewerage, averaged $432,000,000 in 1925–29, and $220,000,000 in 1933-38, a decline of 49 percent. Public residential building was nonexistent before 1934; from that year until 1938 its volume ranged from $1,000,000 in 1934 to $93,000,000 in 1937. The biggest change occurred in conservation and development construction; this category amounted to only $71,000,000 in 1925–29, while in 1933–38 it averaged $269,000,000, a fourfold increase.

Work relief construction has been kept in a separate category, although it includes substantial amounts of most of the above types. It ranged from $138,000,000 in 1933 to $1,222,000,000 in 1936, the average from 1933–38 being $787,000,000. About one-half of this construction was on highways, roads, and streets, and about one-tenth on nonresidential buildings. The remainder consisted mainly of recreational facilities, public services, and conservational work.

In terms of percentages of total public construction, the changing positions of the various types are marked.

ESTIMATED EXPENDITURES FOR NEW CONSTRUCTION, BY TYPES, ACCORDING TO PUBLIC OR PRIVATE AUSPICES, 1925–1938

FIG. 3

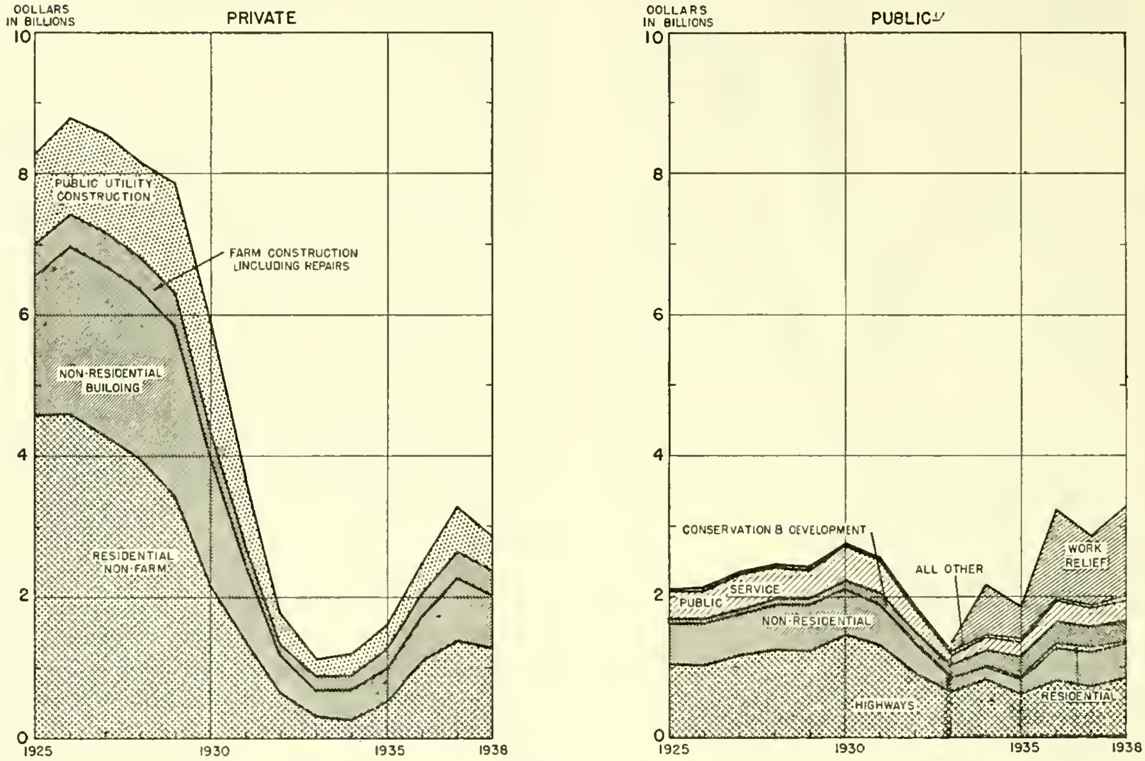
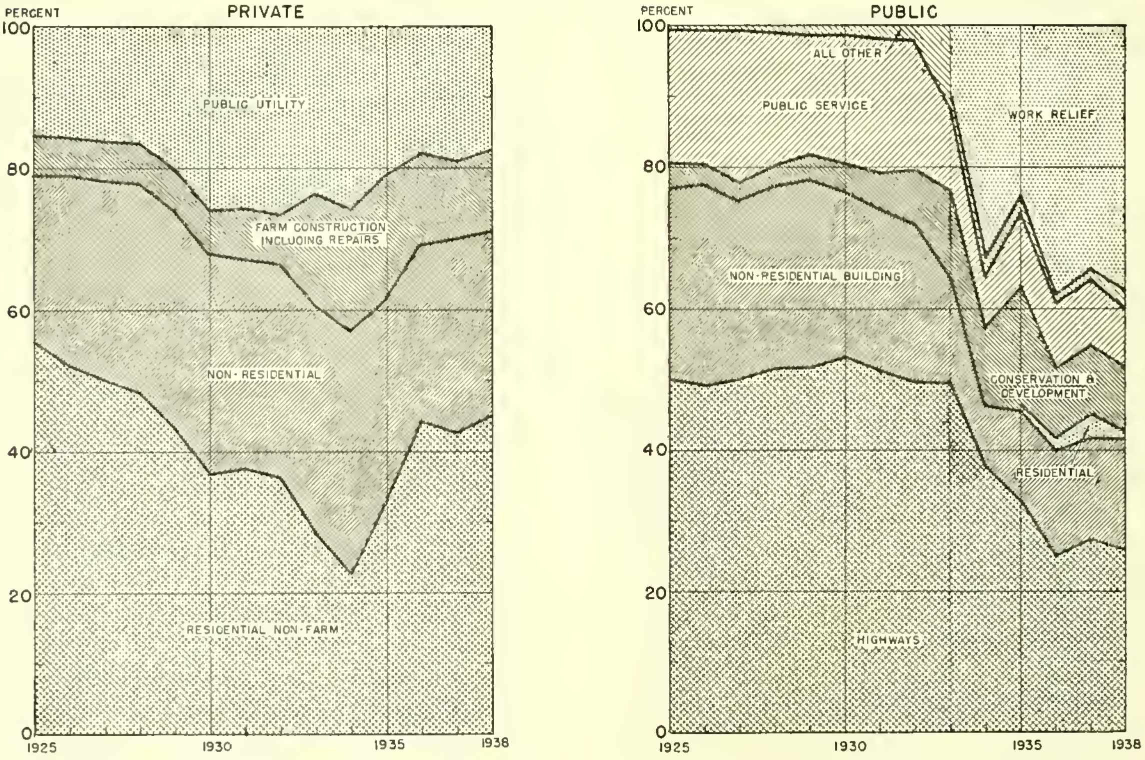


FIG. 4



[1] PUBLIC EXCLUDES SHIPBUILDING AND RAILROAD EQUIPMENT PROJECTS

SOURCE SEE TABLES 5 AND 6

Highway construction (exclusive of work relief) dropped from 50.7 percent in 1925–29 to 30.9 percent in 1933–38; nonresidential building declined from 26.6 percent to 13.6 percent; miscellaneous public services from 18.8 percent to 9.0 percent. On the other hand, conservation and development expenditures increased from 3.1 percent to 11.0 percent, and residential building from zero to 1.3 percent. Furthermore, in 1933–38, work relief construction constituted 32.1 percent of all public construction. If the contents of the work relief category were to be properly distributed among highway and street construction, nonresidential building, and so on, the apparent drop in the relative volume of those types of work would be greatly softened.

To summarize, as the proportion of public works increases relative to that of private construction, we tend to get, at any level of total construction, relatively fewer factories, office buildings, public utilities, and housing, and relatively more highways, schools, recreational facilities, and conservation work. Furthermore, the trend of recent years seems to indicate that, within the field of public works, expenditures for conservation, the development of natural resources, and, as yet in only embryonic form, low-cost housing, are increasing in significance.

Relation of Federal Public Works to Individual Construction Supply Industries

The aggregate figures presented in the previous section give a general picture of the position of expenditures for public works construction with respect to the construction industry as a whole. Some important additional light is thrown on the relation of public works construction to business activity by following, back to the output of specific construction supply industries, the materials purchased for construction projects financed wholly or partially from Federal funds. This provides a partial answer, at least, to the question of the extent to which private industry in recent years has relied on public orders. As indicated by table 7, purchases of construction materials by the Federal Government (or in conjunction with it in the case of Federal-aid highways and the non-Federal PWA program), for which the data are available, amounted to between four and five billions.[3] Of this, the PWA program accounted for approximately one-half and the WPA between one-fifth and one-quarter. To compare these purchases with the output of individual industries, it is necessary that they be broken down by individual materials and compared with the total current output of these materials. Reasonably complete output data within the period are available only for 1933, 1935, and 1937 from the Biennial Census of Manufactures. The record of public purchases of materials is not complete prior to 1934.

Table 7.—*Material orders on construction projects financed wholly or partially from Federal funds* [1]

(In millions of dollars)

Year	PWA	WPA	Other	Total
1933 [2]	76	----------	----------	----------
1934	610	----------	[3] 27	637
1935	439	46	[3] 117	602
1936	434	280	[3] 373	1,087
1937	299	243	[3] 382	924
1938	260	351	[3] 404	1,015
Total 1934–38	2,042	920	[3] 1,303	4,265

[1] All orders on non-Federal PWA, WPA, and Federal-aid highway projects are included; part of the funds for these projects was supplied by States or localities. The construction of naval vessels is also included. In the years 1933 to 1935, CWA and FERA projects provided $219,000,000 of material orders. Full information with respect to these orders, however, is not available, and they are not included in the discussion of this chapter.

[2] Only PWA orders available.

[3] The figures for Federal orders are incomplete, since the amounts of material orders are not available for projects financed by regular appropriations for which contracts were awarded prior to July 1, 1934. This affects particularly the 1934 and 1935 figures.

Source: Bureau of Labor Statistics.

In making this comparison it should be kept in mind that the two sets of figures are not directly comparable. The data on material purchases are for orders while the data for the industries cover actual production. More important, it is possible to obtain only value figures. Data for the industries in the Census of Manufactures are based on manufacturers' selling prices (prices at the mill), while those for material purchases are the prices paid by contractors on the job and include freight and other distribution charges. This has necessitated an estimation of delivery costs. Finally, it should be noted that in the case of non-Federal PWA and Federal-aid highway projects a substantial proportion of the financing was not provided by the Federal Government, while sponsors have provided around 15 percent of the funds for work relief projects.

The question of the delivery costs involved in specific material purchases has been given careful investigation as far as the available information would permit. To compare Federal material purchases valued at delivered prices with total production valued at mill prices would be to overstate the importance of Federal orders. However, very little data are available for estimating the proportion of total cost represented by delivery costs. In general, it has been necessary to fall back on Interstate Commerce Commission figures of average ton revenue received by railroads for transporting specific materials, and to adjust the mill price by this factor; in some few cases, other information has been used. Appendix C explains the methods in detail. For the more important materials the following percentages of total delivered value have been taken to represent the proportion of delivery costs: 26 percent for cement (i. e., 35 percent of mill value), 28 percent for lumber, 20 percent for clay products, 8 percent for iron and steel products, 60 percent for sand and gravel, and 47 percent for crushed stone. The possible range of error is large, of course, in either direction, and the estimates can be considered to indicate only roughly the delivered value of total production. However, the objective of this section is merely to place material purchases in a general relationship with total production, and the estimates are probably adequate for this purpose.

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[3] As stated in the footnote to table 7, figures for Federal purchases from regular appropriations are incomplete, and Civil Works Administration and Federal Emergency Relief Administration orders are not included.

In table 8, and figures 5 and 6, material purchases on construction financed wholly or partially from Federal funds are compared with output for 33 industries serving the construction business, for the years 1935 and 1937 (the biennial census years). In 1935 these public purchases ranged from over 40 percent of output in the case of cement and structural and reinforcing steel, down to less than one percent of the output of paints and varnishes. Similar, although smaller, percentages held in 1937.

In table 9 industries are shown where in 1935 and 1937 such public purchases were the equivalent of 8 percent or more of the output of the industry in 1935 or 1937. It will be observed that in 1935 those orders constituted 8 percent or more of the total output of 14 industries. They were 20 percent or more of the output of 7 industries, 30 percent or more of 3 industries, and 40 percent or more of 2 industries. In 1937 these

TABLE 8.—*Value of material orders on construction projects financed wholly or partially from PWA and all Federal funds, compared with the estimated value of production (including delivery costs) of individual materials for 1935 and 1937*

(In millions of dollars)

	1935			1937			PWA financed orders as percent of total production		Federally financed orders as percent of total production [2]	
	Estimated total production [1]	PWA financed orders	Total federally financed orders [2]	Estimated total production [1]	PWA financed orders	Total federally financed orders [2]	1935	1937	1935	1937
Cast-iron pipe and fittings	$43.9	$12.3	$16.0	$71.9	$11.1	$26.5	28.0	15.4	36.4	36.9
Cement	155.3	46.7	66.2	231.6	21.4	83.5	30.1	9.2	42.6	36.1
Concrete products	58.8	12.9	16.6	100.4	15.1	30.6	21.9	15.0	28.2	30.5
Structural and reinforcing steel	153.6	50.7	70.9	278.5	31.5	84.0	33.0	11.3	46.2	30.2
Elevators and elevator equipment	12.8	2.0	2.3	23.0	2.9	4.9	15.6	12.6	18.0	21.3
Sand and gravel	155.0	28.2	35.3	243.8	11.3	48.9	18.2	4.6	22.8	20.1
Crushed stone	91.9	16.5	22.1	156.2	4.1	28.9	18.0	2.6	24.0	18.5
Doors, shutters, etc. (metal)	27.3	4.9	5.8	53.6	6.2	9.0	17.9	11.6	21.2	16.8
Marble, granite and other stone	77.6	8.8	10.4	108.7	7.1	[5] 17.1	11.3	6.5	13.4	15.7
Brick tile and clay products	112.8	10.6	14.8	201.4	15.5	28.3	9.4	7.7	13.1	14.1
Plumbing supplies, n. e. c	92.7	6.9	8.3	141.1	9.5	15.8	7.4	6.7	9.0	11.2
Engines, turbines, etc.[7]	112.2	12.3	21.5	213.6	3.6	[4] 22.8	11.0	1.7	19.2	10.7
Lumber and timber products, n. e. c.	405.3	18.5	[3] 28.3	598.5	15.0	[5] 50.2	4.6	2.5	7.0	8.4
Tools, other than machine tools	54.7	1.9	5.1	85.0	.3	5.0	3.5	.4	9.3	5.9
Explosives	[3] 40.7	2.2	[4] 3.2	[3] 58.2	1.0	[4] 3.0	5.4	1.7	7.9	5.2
Heating equipment and stoves and ranges	329.0	11.0	12.5	470.5	14.7	20.5	3.3	3.2	3.8	4.4
Pumps and pumping equipment	98.7	7.0	8.6	188.5	2.8	8.2	7.1	1.5	8.7	4.4
Electrical machinery, supplies, etc	998.0	28.8	37.8	1,790.4	24.6	[4] 71.1	2.9	1.4	3.8	4.0
Wall plaster, wall and insulating board	76.2	2.6	3.0	123.0	3.7	4.5	3.4	3.0	3.9	3.7
Nails and spikes	22.5	.5	.6	29.5	.5	1.1	2.2	1.7	2.7	3.7
Roofing materials, n. e. c	[3] 77.0	2.3	2.8	[3] 98.2	2.5	3.6	3.0	2.5	3.6	3.7
Hardware, miscellaneous	157.6	4.2	5.3	229.7	4.5	[4] 8.0	2.7	2.0	3.4	3.5
Foundry and machine shop products	1,564.1	44.4	57.8	[6] 2,608.7	20.7	64.7	2.8	.8	3.7	2.5
Sheet metal work	107.8	1.5	2.3	155.9	2.8	3.9	1.4	1.8	2.1	2.5
Furniture, including store and office fixtures	[3] 441.9	4.1	4.5	[3] 675.8	9.6	13.1	.9	1.4	1.0	1.9
Planing mill products	558.6	3.9	[3] 5.5	911.0	6.9	[5] 18.1	.7	.8	1.0	2.0
Paints and varnishes	[3] 329.7	1.5	2.9	[3] 426.9	1.9	7.9	.5	.4	.9	1.9
Bolts, nuts, washers, etc	75.0	1.3	1.7	135.8	1.0	2.1	1.7	.7	2.3	1.5
Steel works and rolling mill products	1,319.2	29.2	35.1	2,261.6	12.9	[4] 31.8	2.2	.6	2.7	1.4
Petroleum products	[3] 1,830.4	14.9	21.2	[3] 2,537.1	5.7	29.7	.8	.2	1.2	1.2
Steel rails and rail fastenings	41.7	3.0	3.0	84.2	.5	.8	7.2	.6	7.2	1.0
Wrought pipe	233.3	2.8	3.2	435.9	2.3	2.7	1.2	.5	1.4	.6
Machine tools	107.6	2.5	2.7	239.7	.5	1.5	2.3	.2	2.5	.6
Others	----------	38.3	63.2	----------	23.1	168.9	----------	----------	----------	----------
Total	----------	439.2	602.6	----------	299.1	923.9	----------	----------	----------	----------

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[1] Includes allowance for delivery costs (See appendix C.)

[2] Federally financed orders cover only projects on which contracts were awarded after July 1, 1934 except PWA and RFC (after Mar. 16, 1934).

[3] No allowance made for delivery casts owing to lack of data, value represents mill value.

[4] WPA orders not included.

[5] WPA orders estimated.

[6] Estimated.

[7] PWA and total Federally financed orders include tractors, whereas total production excludes them.

Sources: See Appendix C.

TABLE 9.—*Material orders placed on construction projects financed wholly or partially from Federal funds, expressed as percent of total output of individual materials, 1935 and 1937*

	1935	1937
	Percent	*Percent*
Cast-iron pipe and fittings	36	37
Cement	43	36
Concrete products	28	31
Fabricated structural and reinforcing steel	46	30
Elevators and equipment	18	21
Sand and gravel	23	20
Crushed stone	24	19
Doors, shutters, etc. (metal)	21	17
Marble, granite, and other stone products	13	16
Brick and other clay products	13	14
Engines, turbines, etc	19	11
Plumbing and supplies, n. e. c	9	11
Lumber and timber products	7	8
Tools, other than machine tools	9	6
Pumps and equipment	9	4

Source: See appendix C.

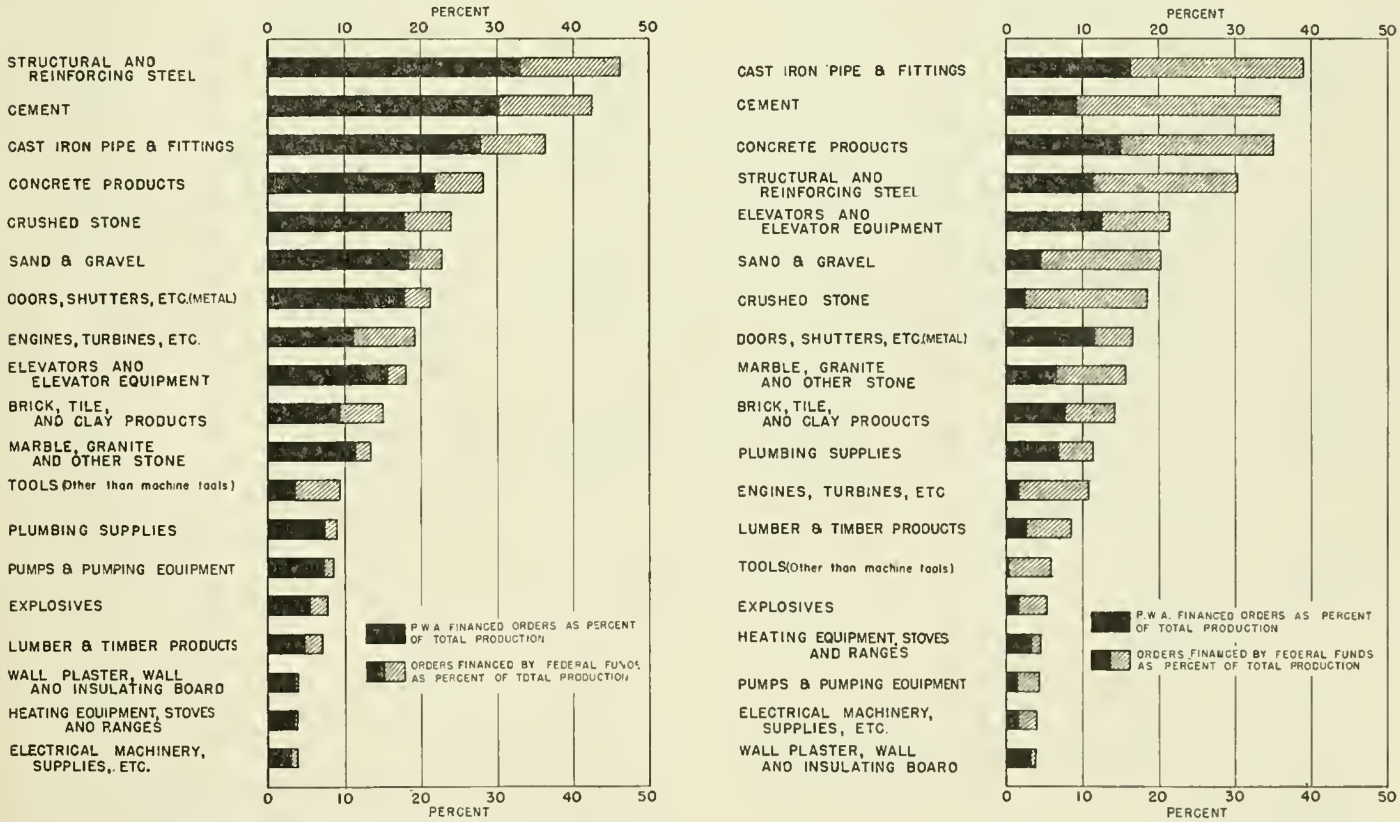
figures ran slightly lower in 8 of the 14 industries. However, in 1935 the volume of such orders was the lowest of any of the 5 years from 1934 to 1938, inclusive, and included only part of the orders on regular Federal projects; and in 1937 industrial output was in general at its highest level. As a consequence, data that cover only the years 1935 and 1937 understate the percentages which these purchases were of the output of individual industries during the entire period under consideration.

For the years 1934, 1936, and 1938, no similar comparison of purchases and output can be made since the data on industrial output are lacking for most industries. For a few industries current production and price statistics are available, and approximate estimates of production have been made by quarterly periods for lumber products, clay products, cement, cast-iron pipe and fittings, and fabricated structural and reinforcing steel. In figures 7 to 16 and tables 10 to 14, output and works purchases are compared for these industries. In the case of sand and gravel and crushed stone, annual values of production are available (although in somewhat incomplete form) from the Bureau of Mines, and these are compared with material orders in figures 17 and 18 and table 15. In table 16 these several estimates are summarized as percentage of total output by years from 1934 to 1938. In line with the conclusion stated above, that the figures for 1935 and 1937 probably understate the proportions for the entire period,

VALUE OF MATERIAL ORDERS PLACED ON CONSTRUCTION PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS, EXPRESSED AS THE PERCENTAGE OF THE TOTAL VALUE OF PRODUCTION, 1935 AND 1937

FIG. 5 - 1935

FIG. 6 - 1937



NOTE. FEDERAL ORDERS COVER ONLY CONTRACTS AWARDED AFTER JULY 1, 1934
ALL ORDERS ON P.W.A NON-FEDERAL AND FEDERAL-AID HIGHWAY PROJECTS ARE INCLUDED
SOURCE: SEE APPENDIX C

it will be noted that the percentages for 1935 and 1937 are substantially lower than those for 1936 and 1938 and in most cases are below the percentages for 1934 (although the data on Federal orders are incomplete for that year).

With several qualifications to be noted subsequently, an examination of these figures and tables roughly indicates the importance of PWA and Federal construction activities to the levels of output in the seven industries covered. From 1934 to 1938, in the case of cement, orders on projects financed wholly or partially from Federal funds ranged from 36 percent to 52 percent of total annual output; for fabricated structural and reinforcing steel, the range was from 30 percent to 48 percent; for cast-iron pipe and fittings, from 33 percent to 76 percent. In the case of brick, tile, and clay products the percentage varied from 10 percent to 22 percent, and for lumber and timber products from 7 percent to 13 percent. Orders on federally financed projects represented from 20 percent to 29 percent of annual sand and gravel production, and from 19 percent to 27 percent of crushed stone. It should be emphasized again that the figures for federally

TABLE 10.—*Lumber and timber products: Value of material orders placed on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production, by quarters, 1933–38*

[In millions of dollars]

Year and quarter	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
1933 (6 months)	$159.3	$4.7	$4.7	3.0	3.0
1934:					
First	79.2	5.0	[2] 5.0	6.3	[2] 6.3
Second	89.3	8.8	[2] 9.4	9.9	[2] 10.6
Third	79.6	7.1	[2] 7.6	8.9	[2] 9.5
Fourth	69.0	7.8	[2] 8.5	11.3	[2] 12.3
Total	317.1	28.7	[2] 30.5	9.1	[2] 9.6
1935:					
First	78.5	4.2	4.8	5.4	6.1
Second	92.8	5.6	6.2	6.9	6.7
Third	119.0	4.9	6.7	4.1	6.6
Fourth	115.0	3.9	10.6	3.4	9.2
Total	405.3	18.6	[3] 28.3	4.6	7.0
1936:					
First	109.7	4.4	13.8	4.0	12.6
Second	138.9	7.4	18.7	5.3	13.5
Third	148.8	6.6	17.6	4.4	11.8
Fourth	135.7	5.9	17.3	4.3	12.7
Total	533.1	24.3	[3] 67.4	4.6	12.6
1937:					
First	131.6	3.7	12.8	2.8	9.7
Second	172.2	4.1	12.4	2.4	7.2
Third	169.3	4.3	12.9	2.5	7.6
Fourth	123.4	2.9	12.1	2.4	9.8
Total	596.5	15.0	[3] 50.2	2.5	8.4
1938:					
First	94.4	2.7	13.2	2.9	14.0
Second	105.6	2.7	12.8	2.6	12.1
Third	123.1	2.3	12.7	1.9	10.3
Fourth	111.1	6.2	17.3	5.6	15.6
Total	434.2	13.9	[3] 56.0	3.2	12.9
Total 1934–38	2,286.2	100.4	232.4	4.4	10.2

[1] Includes an allowance of 28 percent (of total delivered value) for delivery costs.

[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects).

[3] WPA orders are estimated.

Source: See appendix C.

TABLE 11.—*Brick, tile, and clay products: Value of material orders placed on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production, by quarters, 1934–38*

[In millions of dollars]

Year and quarter	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
1934:					
First	$12.3	$0.8	$0.8	6.5	6.5
Second	21.9	1.6	1.6	6.8	7.3
Third	24.8	2.7	2.8	10.9	11.3
Fourth	23.8	2.7	2.8	11.3	11.8
Total	82.8	7.7	8.0	9.3	9.7
1935:					
First	11.6	2.2	2.3	19.0	19.8
Second	27.4	2.7	2.9	9.9	10.6
Third	38.0	3.0	3.4	7.9	8.9
Fourth	35.8	2.7	6.2	7.5	17.3
Total	112.8	10.6	14.8	9.4	13.1
1936:					
First	18.8	3.7	7.7	19.7	41.0
Second	56.0	7.7	11.8	13.8	21.1
Third	64.0	8.1	12.6	12.7	19.7
Fourth	59.6	6.1	10.5	10.2	17.6
Total	198.4	25.6	42.6	12.9	21.5
1937:					
First	30.8	4.1	7.7	13.3	25.0
Second	67.8	5.0	8.2	7.4	12.1
Third	59.8	3.9	6.6	6.5	11.0
Fourth	43.0	2.5	5.8	5.8	13.6
Total	201.4	15.5	28.3	7.7	14.1
1938:					
First	17.8	2.4	7.1	13.5	39.9
Second	38.3	3.3	8.0	8.6	20.9
Third	49.7	2.8	7.1	5.6	14.3
Fourth	55.8	4.9	9.2	8.8	16.5
Total	161.6	13.4	31.4	8.3	19.4
Total 1934–38	757.0	72.8	125.0	9.6	16.5

[1] Includes an allowance of 20 percent (of total delivered value) for delivery costs.

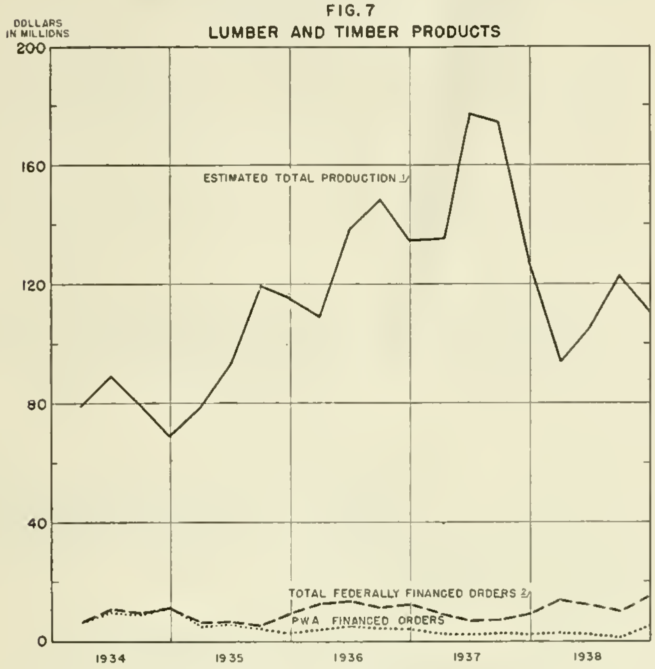
[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects).

Source: See appendix C.

VALUE OF MATERIAL ORDERS PLACED ON CONSTRUCTION PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS, BY QUARTERS, 1934-1938

COMPARED WITH THE ESTIMATED VALUE OF TOTAL PRODUCTION

FIG. 7


LUMBER AND TIMBER PRODUCTS

EXPRESSED AS PERCENT OF ESTIMATED VALUE OF TOTAL PRODUCTION

FIG. 8

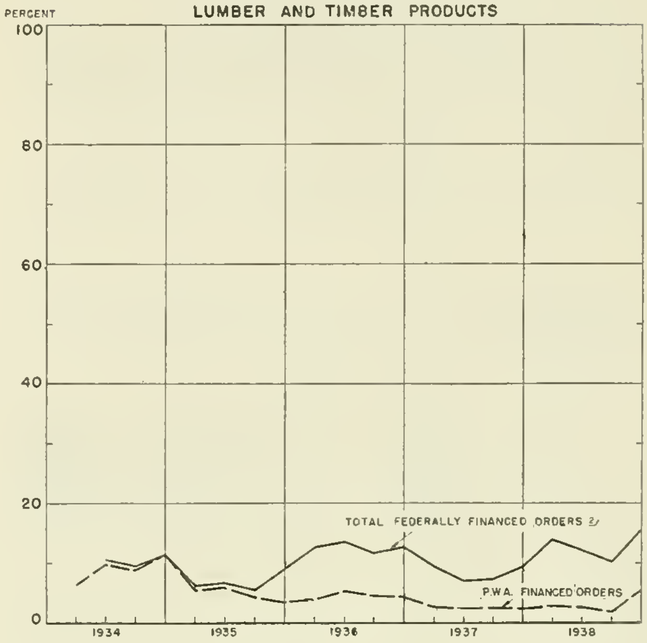

LUMBER AND TIMBER PRODUCTS

FIG. 9

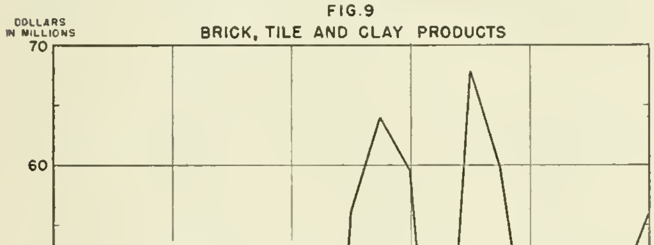
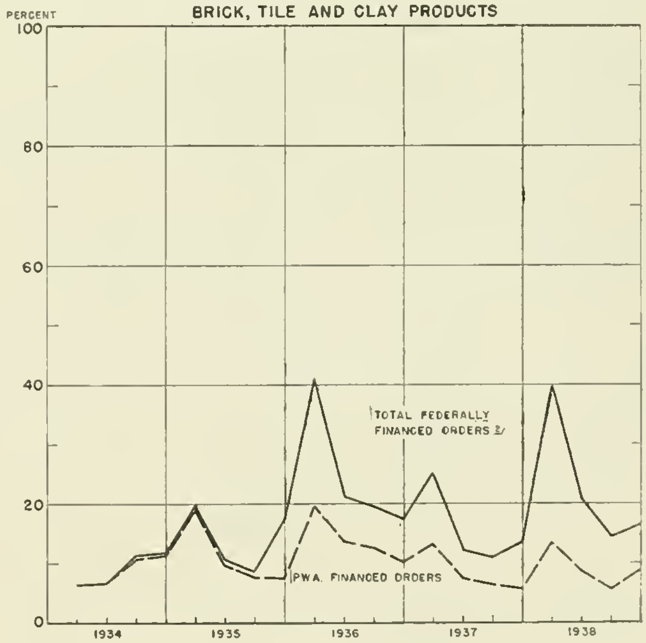

BRICK, TILE AND CLAY PRODUCTS

FIG. 10


BRICK, TILE AND CLAY PRODUCTS

1/ INCLUDES AN ALLOWANCE OF 28 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS

2/ FEDERAL ORDERS COVER ONLY CONTRACTS AWARDED AFTER JULY 1, 1934, EXCEPT PWA PROJECTS AND RFC PROJECTS (AFTER MARCH 15, 1934).

3/ INCLUDES AN ALLOWANCE OF 20 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS.

SOURCES: SEE APPENDIX C.

financed orders do not include orders on regular Federal projects for which contracts were awarded before July 1, 1934, and consequently the percentages for 1934 and 1935, in particular, are understated.

The proportions of total output represented by orders on projects financed wholly or partially by PWA alone were relatively high in 1934, and thereafter tended to become progressively less as the PWA program fell off and other Federal activities expanded.

However, it is not enough to say that orders on federally financed projects represented, for example, 44 percent of cement production from 1934 to 1938. The percentages which orders represent of total output are by themselves of little significance; they must be considered in relation to the level of activity in the industries involved. A large percentage of such purchases in 1933 as compared with 1929 may merely mean that public works construction has held up better than private construction, and does not preclude the possibility that public works activity is itself below the normal level. Furthermore, consideration must also be given to movements in inventories. To the extent that material orders may have been filled at various times out of stocks rather than by increased produc-

TABLE 12.—*Cement: Value of material orders placed on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production, by quarters, 1933–38*

[In millions of dollars]

Year and quarter	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
1933 (6 months)	$68.8	$10.2	$10.2	14.8	14.8
1934:					
First	27.6	7.0	[2] 7.0	25.4	[2] 25.4
Second	48.9	22.7	[2] 23.1	46.4	[2] 47.2
Third	48.2	21.6	[2] 22.2	44.8	[2] 46.1
Fourth	35.5	30.8	[2] 31.4	86.8	[2] 88.5
Total	160.2	82.1	[2] 83.7	51.2	[2] 52.2
1935:					
First	21.3	6.8	7.1	32.1	33.5
Second	46.9	14.1	15.3	30.1	32.6
Third	45.5	16.6	19.6	36.5	43.1
Fourth	41.6	9.2	24.2	22.1	58.2
Total	155.3	46.7	66.2	30.1	42.6
1936:					
First	25.5	5.0	15.5	19.6	60.8
Second	63.6	8.3	25.7	13.1	40.4
Third	74.3	11.3	34.3	15.2	46.2
Fourth	66.5	7.6	27.1	11.4	40.8
Total	229.9	32.2	102.6	14.0	44.6
1937:					
First	41.5	4.4	14.8	10.6	35.7
Second	66.0	6.8	21.4	10.3	32.4
Third	69.0	6.1	27.3	8.8	39.6
Fourth	55.1	4.1	20.0	7.4	36.3
Total	231.6	21.4	83.5	9.2	36.1
1938:					
First	29.6	2.6	18.4	8.8	62.2
Second	60.1	3.9	26.5	6.5	44.1
Third	68.0	2.9	30.0	4.3	44.1
Fourth	62.2	5.5	26.0	8.8	41.8
Total	219.9	14.9	100.9	6.8	45.9
Total 1934–38	996.9	197.3	436.9	19.8	43.8

[1] Includes an allowance of 26 percent (of total delivered value) for delivery costs.

[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects). Source: See appendix C.

TABLE 13.—*Fabricated structural and reinforcing steel: Value of material orders placed on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production by quarters, 1934–38*

[In millions of dollars]

Year and quarter	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
1934:					
First	$25.9	$12.4	[2] $12.4	47.9	47.9
Second	44.9	12.7	[2] 14.2	28.3	[2] 31.6
Third	30.3	11.4	[2] 13.0	37.6	[2] 42.9
Fourth	26.5	10.2	[2] 14.5	38.5	[2] 54.7
Total	127.6	46.7	[2] 54.1	36.6	[2] 42.4
1935:					
First	29.9	9.1	16.0	30.4	53.5
Second	37.8	10.6	14.6	28.0	38.6
Third	41.3	19.0	22.1	46.0	53.5
Fourth	44.6	12.0	18.2	26.9	40.8
Total	153.6	50.7	70.9	33.0	46.2
1936:					
First	47.7	11.2	22.9	23.5	48.0
Second	64.6	16.1	29.0	24.9	44.9
Third	74.7	15.7	33.8	21.0	45.2
Fourth	63.0	11.8	28.0	18.7	44.4
Total	250.0	54.8	113.7	21.9	45.5
1937:					
First	78.8	7.0	18.4	8.9	23.4
Second	90.9	9.9	21.6	10.9	23.8
Third	70.8	8.5	24.7	12.0	34.9
Fourth	38.0	6.1	19.3	16.1	50.8
Total	278.5	31.5	84.0	11.3	30.2
1938:					
First	34.5	6.2	17.2	18.0	49.9
Second	35.7	6.4	17.6	17.9	49.3
Third	41.0	5.9	19.8	14.4	48.3
Fourth	44.2	9.5	19.9	21.5	45.0
Total	155.4	28.0	74.5	18.0	47.9
Total 1934–38	965.1	211.7	397.2	21.9	41.2

[1] Includes an allowance of 8 percent (of total delivered value) for delivery costs.

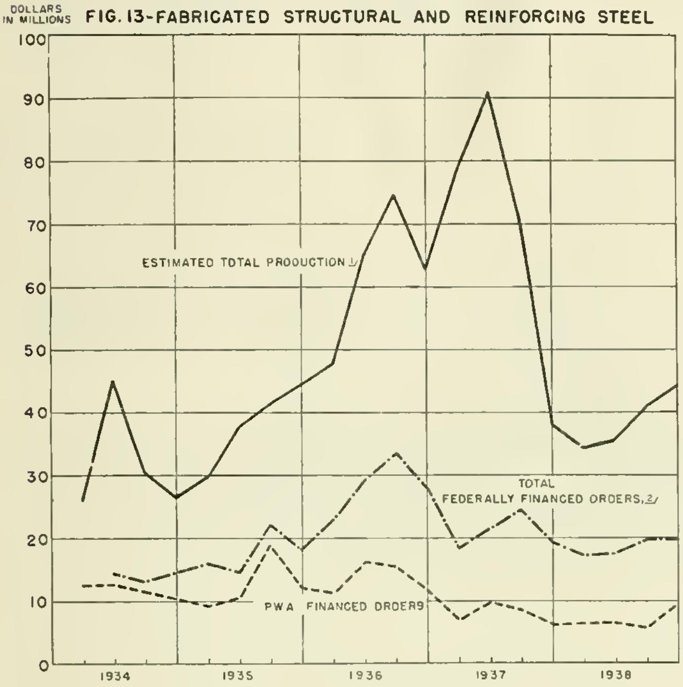
[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects).

Sources: See appendix C.

VALUE OF MATERIAL ORDERS PLACED ON CONSTRUCTION PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS, BY QUARTERS, 1934-1938

COMPARED WITH THE ESTIMATED VALUE OF TOTAL PRODUCTION

FIG. 13-FABRICATED STRUCTURAL AND REINFORCING STEEL



EXPRESSED AS PERCENT OF ESTIMATED VALUE OF TOTAL PRODUCTION

FIG. 14 - FABRICATED STRUCTURAL AND REINFORCING STEEL

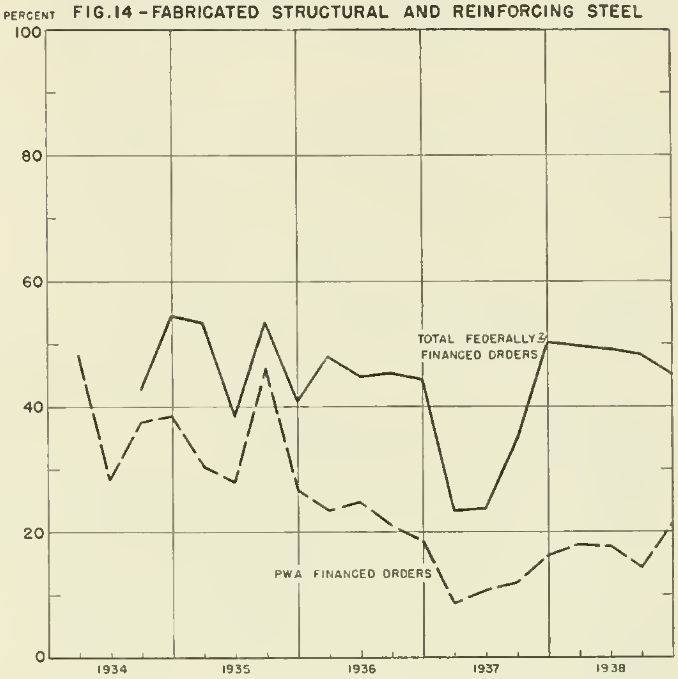


FIG. 15-CAST IRON PIPE AND FITTINGS

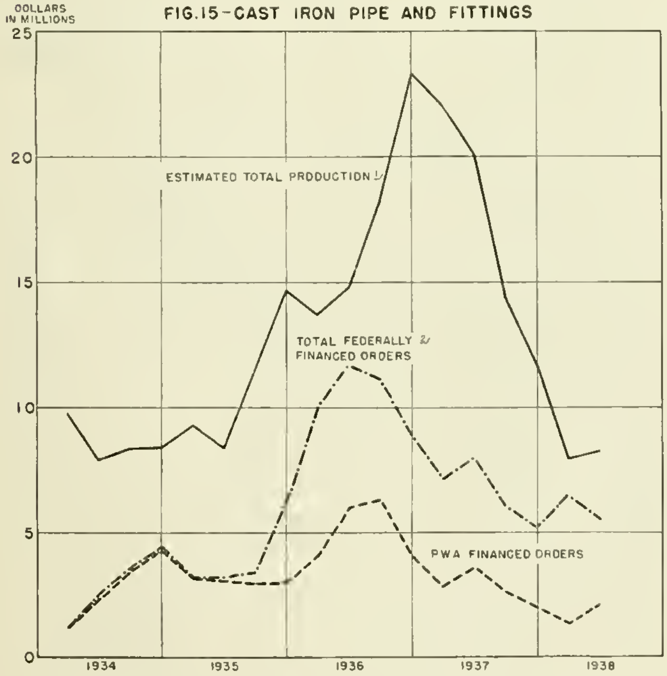
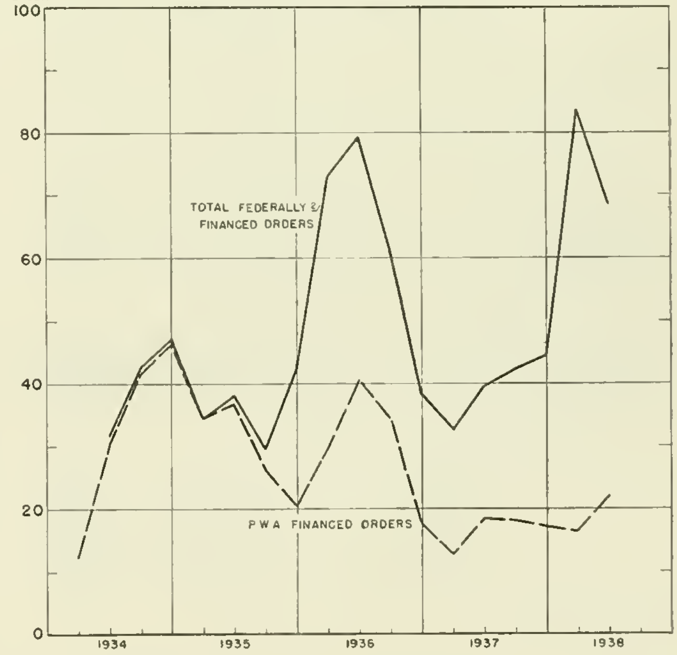


FIG. 16-CAST IRON PIPE AND FITTINGS



1/ INCLUDES AN ALLOWANCE OF 8 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS
2/ FEDERAL ORDERS COVER ONLY CONTRACTS AWARDED AFTER JULY 1, 1934, EXCEPT PWA PROJECTS AND RFC PROJECTS (AFTER MARCH 15, 1934)
SOURCES SEE APPENDIX C

TABLE 14.—*Cast-iron pipe and fittings: Value of material orders placed on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production by quarters, 1934–38*

[In millions of dollars]

Year and quarter	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
1934:					
First	$9.8	$1.2	[2] $1.2	12.2	[2] 12.2
Second	7.9	2.4	[2] 2.5	30.4	[2] 31.6
Third	8.4	3.5	[2] 3.6	41.7	[2] 42.9
Fourth	9.3	4.3	[2] 4.4	46.2	[2] 47.3
Total	35.4	11.4	[2] 11.7	32.2	[2] 33.1
1935:					
First	9.3	3.2	3.2	34.4	34.4
Second	8.4	3.1	3.2	36.9	38.1
Third	11.5	3.0	3.4	26.1	29.6
Fourth	14.7	3.0	6.2	20.4	42.2
Total	43.9	12.3	16.0	28.0	36.4
1936:					
First	13.7	4.1	10.0	29.9	73.0
Second	14.8	6.0	11.7	40.5	79.1
Third	18.2	6.3	11.2	34.6	61.5
Fourth	23.3	4.1	8.9	17.6	38.2
Total	70.0	20.5	41.8	29.3	59.7
1937:					
First	23.2	2.8	7.2	12.1	31.0
Second	21.2	3.7	8.0	17.5	37.7
Third	15.2	2.6	6.1	17.1	40.1
Fourth	12.3	2.0	5.2	16.3	42.3
Total	71.9	11.1	26.5	15.4	36.9
1938: [3]					
First	7.9	1.3	6.6	16.5	83.5
Second	8.2	1.7	5.6	20.7	68.3
Total (6 months)	16.1	3.0	12.2	18.6	75.8
Total 1934–38	237.3	58.3	108.2	24.6	45.6

[1] Includes an allowance of 8 percent (of total delivered value) for delivery costs.

[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects).

[3] Estimates for total production during July–December 1938 not determinable.

Source: See appendix C.

TABLE 15.—*Sand and gravel and crushed stone: Value of material orders on construction projects financed wholly or partially from Federal funds compared with the estimated value of total production, by years, 1933–38*

[In millions of dollars]

	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
Sand and gravel:					
1933	$132.8	[3] $6.0	[3] $6.0	4.5	4.5
1934	153.0	38.1	[2] 38.7	24.9	[2] 25.3
1935	155.0	28.2	35.3	18.2	22.8
1936	225.8	20.0	60.3	8.9	26.7
1937	243.8	11.3	48.9	4.6	20.1
1938	214.8	8.1	62.4	3.8	29.1
Total 1934–38	992.4	105.7	245.6	10.7	24.7

TABLE 15.—*Sand and gravel and crushed stone: Value of material orders on construction projects financed wholly or partially from Federal funds, compared with the estimated value of total production, by years, 1933–38*—Continued

[In millions of dollars]

	Estimated value of total production (delivered at site) [1]	PWA financed orders	Total federally financed orders [2]	PWA financed orders as percent of total production	Total federally financed orders as percent of total production [2]
Crushed stone:					
1933	$62.3	[3] $4.0	[3] $4.0	[3] 6.4	[3] 6.4
1934	106.4	21.6	[2] 21.8	20.3	20.5
1935	91.9	16.5	22.1	18.0	24.0
1936	154.9	7.3	34.4	4.7	22.2
1937	154.2	4.1	28.9	2.7	18.7
1938	167.8	2.7	45.7	.6	27.2
Total 1934–38	677.2	52.2	152.9	7.7	22.6

[1] Includes an allowance of 60 percent (of total delivered) value for delivery costs for sand and gravel, and 47 percent for crushed stone.

[2] Covers orders only on contracts awarded after July 1, 1934 (except PWA and RFC projects).

[3] 6 months only. Source: See appendix C.

VALUE OF MATERIAL ORDERS PLACED ON CONSTRUCTION PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS

FIG 17

COMPARED WITH THE ESTIMATED VALUE OF TOTAL PRODUCTION, BY YEARS, 1933-1938

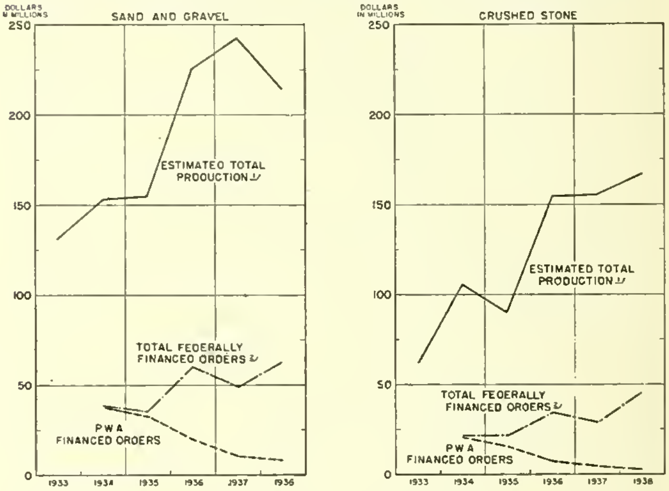
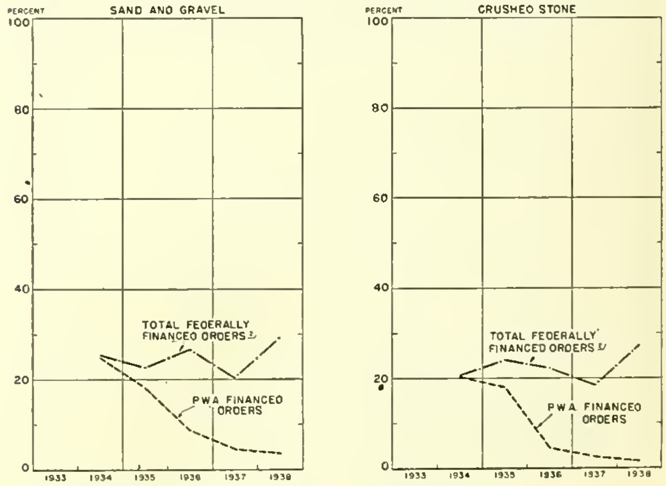


FIG 18

EXPRESSED AS PERCENT OF ESTIMATED VALUE OF TOTAL PRODUCTION BY YEARS, 1934-1938



1/ INCLUDES AN ALLOWANCE OF 60 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS FOR SAND AND GRAVEL AND 47 PERCENT FOR CRUSHED STONE

2/ FEDERAL ORDERS COVER ONLY CONTRACTS AWARDED AFTER JULY 1 1934, EXCEPT PWA PROJECTS AND R F C PROJECTS (AFTER MARCH 15,1934)

SOURCE SEE APPENDIX C

TABLE 16.—*Material orders on construction projects financed wholly or partially from Federal funds, expressed as percent of total output [1] of seven materials, 1934–38*

	1934 [2]	1935	1936	1937	1938	Total 1934–38
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Lumber and timber products	10	7	13	8	13	10
Brick and clay products	10	13	22	14	19	17
Cement	52	43	45	36	46	44
Cast-iron pipe and fittings	33	36	60	37	[3] 76	46
Fabricated structural and reinforcing steel	42	46	46	30	48	41
Sand and gravel	25	23	27	20	29	25
Crushed stone	21	24	22	19	27	23

[1] Includes estimated allowances for delivery costs. (See appendix C.)

[2] Federal orders cover only contracts awarded after July 1, 1934 (except PWA and RFC projects).

[3] January-June only.

Source: See appendix C.

tion, the stimulating effect of the public works orders would be modified or delayed. It would be definitely misleading to link orders directly to the volumes of output. Consequently, before drawing final conclusions from the data in this section, certain problems with respect to inventories, capacities, and level of output must be explored.

Movements in Inventories

If material orders on construction projects are filled by depleting stocks over a substantial interval of time to levels below those at which they would otherwise be maintained, there is no direct immediate stimulus to production. The effects on business activity will be quite different from those when orders are filled by current production. The distribution of income is affected as well as the level of output. The money received from material orders instead of being used for the further purchase of materials, labor, or capital goods is siphoned off into profits or overhead expenses, and any further stimulating effects may be indefinitely delayed. Moreover, the money so received may not be distributed in income payments of any types, but may be used for the purpose of achieving greater asset liquidity or a reduction of bank liabilities, in which case no further effects on income result. The extremely low level of construction activity in the period after 1930 increased the likelihood, on a priori analysis, of a heavy accumulation of stocks. This created the possibility at least that increased construction following 1933, which we have seen was largely a result of increased Federal financing, would be utilized as an opportunity for unloading inventories in the construction supply industries.

Unfortunately, data on inventory movements are not generally available for the various construction industries, and no final conclusions as to the extent of inventory withdrawals during the period can be drawn. For a few materials, namely, common brick, face brick, building tile, cement, lumber (all types), western pine, and southern pine, current inventory statistics do exist, and the basis exists for a rough estimate of changes in stocks of cast-iron fittings. Something can be made of the inventory movements in these particular industries.

Table 17 shows the changes in the inventories of those commodities by quarters from 1933 to 1938, and table 18 gives the inventory changes expressed as a percent-

TABLE 17.—*Changes in stocks of 8 construction materials, by quarters, 1933–38*

Year and quarter	Portland cement	Common brick	Face brick	Hollow building tile	Cast-iron fittings [1]	Lumber (all types)	Western pine	Southern pine
	Millions of barrels	*Millions of brick*	*Millions of brick*	*Thousands of short tons*	*Short tons*	*Millions of b. m. feet*	*Millions of b. m. feet*	*Millions of b. m. feet*
1933:								
Third	+0.95	[2]	[2]	[2]	−1,415	−116	+55	−2
Fourth	−2.47	[2]	[2]	[2]	+9	+150	+28	+91
Total	−1.52	[2]	[2]	[2]	−1,406	+34	+83	+89
1934:								
First	+2.48	−30.9	−9.0	−20.3	+205	+275	−100	+134
Second	+.28	−11.9	−10.9	−14.0	−35	+345	+147	+24
Third	−.31	+11.3	−3.9	−19.4	−1,357	−107	+68	−49
Fourth	−.08	−4.6	+1.3	+.5	+2,308	−330	−35	−111
Total	+2.37	−36.1	−22.5	−53.2	+1,121	+183	+80	−2
1935:								
First	+0	−48.9	−6.2	−19.4	+506	−384	−280	+31
Second	+2.19	−22.2	−13.1	−16.3	−1,277	−392	+51	−256
Third	−1.67	+53.7	−9.8	+7.1	−1,633	+355	+345	+29
Fourth	+.01	+31.6	+7.0	−4.0	+553	+339	+125	+123
Total	+.53	+14.2	−22.1	−32.6	−1,851	−82	+241	−73
1936:								
First	−1.38	−62.7	+7.3	−19.4	+822	−318	−234	−58
Second	−2.57	+4.7	−24.7	−6.3	−214	+107	+154	+15
Third	−.61	+51.3	+5.1	−1.8	−5,047	+330	+282	−9
Fourth	+4.47	+36.6	+20.5	+34.1	+2,415	−47	−67	−70
Total	−.09	+29.9	+8.2	+6.6	−2,024	+72	+135	−122
1937:								
First	+5.12	−69.6	+8.0	+14.2	+1,162	−813	−381	−113
Second	−1.80	+48.4	+0	+8.7	+3,843	+548	+240	+334
Third	−4.08	+73.5	−1.6	−5.9	−1,446	+740	+459	+33
Fourth	+3.93	+19.8	+8.6	+19.8	+130	+526	+71	+207
Total	+3.17	+72.1	+15.0	+36.8	+3,689	+1,001	+389	+461
1938:								
First	−1.62	−83.2	−16.1	−35.7	−2,689	−273	−396	−10
Second	−.91	−13.5	−17.1	−.8	−4,753	+25	+139	+42
Third	−1.81	+22.5	−2.9	+.7		−112	+185	−109
Fourth	+2.35	+23.9	+14.4	+2.0		−187	−95	−95
Total	−1.99	−50.3	−21.7	−33.8	−7,442	−547	−167	−172
1933–38 (total net change)	+2.47	+29.8	−43.1	−76.2	−7,913	+661	+761	+181

[1] Excess of production over shipments.

[2] Not available.

Source: *Survey of Current Business.*

age of current production. In the case of cast-iron fittings, the excess of production over shipments is used under the assumption that it indicates roughly the movements in stocks. In the case of common brick, face brick, and building tile, production is estimated from shipment and stock figures. The only material which corresponds in these classifications to those employed in the estimates in the preceding section is cement. The class of common brick, face brick, and building tile for which inventory reports are available constitute about a quarter of the total class "clay products"; the reported cast-iron fittings constituted about 12 percent of "cast-iron pipe and fittings"; lumber (all types), is a larger class than "lumber and timber products" as well as representing, in part, an earlier stage of production; and western pine and southern pine are component parts of total lumber production. Nevertheless, these figures at least indicate the movements which occurred in portions of a few industries covered in the previous section.

TABLE 18.—*Changes in stocks of 8 construction materials expressed as percent of current production, by quarters, 1933–38*

Year and quarter	Portland cement	Common brick [1]	Face brick [1]	Hollow building tile [1]	Cast-iron fittings [2]	Lumber (all types)	Western pine	Southern pine
1933:								
Third	+4.2	(3)	(3)	(3)	−9.5	−2.4	+5.7	−0.1
Fourth	−14.3	(3)	(3)	(3)	+.1	+3.7	+5.0	+6.6
Total	−3.8	(3)	(3)	(3)	−5.0	+.4	+5.4	+3.1
1934:								
First	+18.8	−31.9	−32.3	−32.1	+1.5	+7.1	−26.7	+11.5
Second	+1.2	−6.9	−21.0	−13.1	−.3	+7.9	+16.2	+1.9
Third	−1.3	+5.6	−6.4	−19.3	−11.8	−2.8	+8.0	−4.6
Fourth	−.5	−2.5	+2.2	+0.5	+14.1	−9.8	−6.8	−11.0
Total	+3.1	−5.5	−11.2	−14.2	+2.2	+1.2	+3.0	0
1935:								
First	0	−55.1	−18.8	−32.7	+4.0	−10.2	−79.5	+2.5
Second	+9.5	−9.8	−16.5	−15.1	−11.3	−8.8	+5.2	−17.9
Third	−7.4	+16.1	−9.9	+5.0	−10.5	+6.2	+25.3	+1.8
Fourth	+.1	+9.9	+7.3	−3.1	+2.8	+6.1	+13.1	+7.5
Total	+.7	+1.5	−7.2	−7.4	−3.1	−.4	+6.6	−1.2
1936:								
First	−11.1	−42.3	+10.7	−24.4	+5.0	−6.3	−43.4	−3.8
Second	−8.3	+.9	−15.4	−2.7	−1.2	+1.7	+12.4	+.8
Third	−1.7	+9.0	+2.7	−.7	−23.2	+4.9	+18.6	−.5
Fourth	+13.8	+6.9	+12.4	+13.1	+8.6	−.8	−6.1	−3.5
Total	−.1	+1.7	+1.4	+.8	−2.4	+.3	+3.1	−1.7
1937:								
First	+24.5	−22.0	+7.0	+7.2	+4.2	−15.0	−59.6	−6.1
Second	−5.4	+7.9	0	+3.0	+15.0	+7.7	+16.0	+16.8
Third	−11.8	+13.3	−1.0	−2.5	−7.9	+10.6	+27.1	+1.8
Fourth	+14.2	+5.0	+7.4	+10.8	+.9	+10.3	+7.9	+12.6
Total	+2.7	+3.8	+2.6	+4.1	+4.3	+4.1	+8.2	+6.3
1938:								
First	−11.3	−47.4	−24.2	−38.4	−26.3	−6.5	−95.0	−.6
Second	−3.2	−8.4	−13.3	−.4	−45.7	+.5	+12.8	+2.6
Third	−5.6	+5.1	−2.0	+.4	(1)	−2.0	+12.7	−5.9
Fourth	+7.9	+5.0	+9.6	+1.2	(1)	−3.8	−9.8	−5.9
Total	−1.9	−3.4	−4.5	−5.4	[4]−36.1	−2.8	−4.2	−2.6
1933–38 (total net change)	+.5	+.4	−2.0	−2.4	−2.4	+.6	+3.6	+.5

[1] Production calculated from shipments and stocks.
[2] Excess of production over shipments used as changes in stocks.
[3] Not available.
[4] January–June only.

Source: *Survey of Current Business.*

Table 19 summarizes the annual stock changes expressed as a percent of current production for the 8 products involved. This table would appear to indicate that in the case of these 8 materials, so far as statistics are available, increases or decreases in inventories have not been important, in general, in filling orders over an annual period. Only in 3 cases (out of 45) did the movements in stocks exceed 10 percent of current production and only in 11 cases did they exceed 5 percent. While from 1933 to 1938 there was no common trend upward or downward, the stocks of all 8 commodities were increased in 1937 and decreased in 1938, although the changes were small relative to production. The one exception was a 36-percent decrease in stocks of cast-iron fittings during January to June 1938 which accounts for the exceptionally high ratio (76 percent) of federally financed orders to total production in this period. Quarterly data which are available indicate that if production and shipments could be estimated during the last half year, the relative reduction in inventory over the year as a whole would have been much smaller.

For the period 1933 to 1938 as a whole, the proportion of the production of these commodities represented by inventory changes was insignificant, the range being from plus 3.6 percent to minus 2.4 percent; there was no general trend upward or downward, 3 commodities showing a decrease for the period and 5 showing an increase.

An examination of the quarterly table, however, indicates that movements in inventories may possess

TABLE 19.—*Changes in stocks of 8 construction materials expressed as percent of current production, by years 1933–38*

Year	Portland cement	Common brick	Face brick	Hollow building tile	Cast-iron pipe and fittings	Lumber and timber products	Western pine	Southern pine
1933 [1]	−3.8	------	------	------	−5.0	+0.4	+5.4	+3.1
1934	+3.1	−5.5	−11.2	−14.2	+2.2	+1.2	+3.0	+0
1935	+.7	+1.5	−7.2	−7.4	−3.1	−.4	+6.6	−1.2
1936	−.1	+1.7	+1.4	+.8	−2.4	+.3	+3.1	−1.7
1937	+2.7	+3.8	+2.6	+4.1	+4.3	+4.1	+8.2	+6.3
1938	−1.9	−3.4	−4.5	−5.4	[2]−36.1	−2.8	−4.2	−2.6
Net 1933–38	+.5	+.4	−2.0	−2.4	−2.4	+.6	+3.6	+.5

[1] July to December only.
[2] January to June only.

Source. See table 18.

more importance for specific short-run periods. In particular, this would seem to be true during the last quarter of 1937 when a substantial increase in stocks occurred for all the materials and in the first quarter of 1938 when a large decrease occurred. Consequently, there is some basis for believing that the stimulating effects of a public works program on production will, in part, be delayed for a period when the program is inaugurated at the time of a sharp decline in business activity and when the decline has been preceded by a substantial accumulation of stocks.

Relation of Federally Financed Material Purchases to the Level of Output in Construction Supply Industries

The percentages of total output which material orders on federally financed projects represent, even after consideration has been given to inventory movements, must be related to the levels of activity of the industries concerned. Total construction, as already noticed, had fallen drastically by 1933 and failed to recover its former levels in subsequent years. Table 20, which presents an index of total new construction based on the average volume from 1925 to 1929, shows the extent of the relative decline.

Construction volume (including work relief) in 1933 stood at 23 percent of the 1925–29 level and by 1938 had increased to only 60 percent; the average from 1933 to 1938 was 43 percent and, excluding work relief, it was 36 percent. It would be expected that the construction supply industries were operating at a low level of total capacity, and a survey of the specific industries shows that this was the case. In table 20 an index of production (by value) for 1933, 1935, and 1937, is given for those materials of which federally financed orders constituted a substantial proportion. The base year in this case is 1929. In 1933 the value of output in this group of industries ranged from 12 percent to 41 percent of 1929. In 1935 the same range was from 27 percent to 52 percent. However the 1935, and still more the 1937, figures show a marked recovery toward the predepression output. It is interesting and important to note that the output of those materials of which federally financed orders constituted the largest relative proportion tended also to show a greater recovery than the output of the other materials covered. Further, the levels of output of materials in which such orders were concentrated were in most cases higher than the levels of construction activity in general, relative to 1929. However, only in one case did output in the peak year of 1937 exceed 80 percent of the 1929 figure, and the median percent for all 11 materials was 67. The recovery in all cases was far from complete. If the federally financed orders are applied to the output of the individual industries as they stood before the depression, then their relation to business activity appears less important than previous sections may have indicated, although the somewhat lower level of most material prices at present would have to be taken into consideration. The Federal Government by itself cannot bring prosperity to the construction industry, with expenditures for public works at levels such as those that held from 1936 to 1938.

TABLE 20.—*Index of total new construction*

[1925–29=100]

	Excluding work relief	Including work relief
Average, 1925–29	100	
1930	82	
1931	59	
1932	33	
1933	22	23
1934	25	32
1935	28	32
1936	43	54
1937	49	58
1938	48	60
Average 1933–38	36	43

Source: Department of Commerce estimates, except work relief construction figures which are WPA estimates.

TABLE 21.—*Index of production (by value) of selected construction materials for 1933, 1935, and 1937, based on value produced in 1929*

[1929=100]

	1933	1935	1937
Crushed stone	41	52	88
Concrete products	21	47	80
Sand and gravel	40	47	73
Cast-iron pipe and fittings	26	47	73
Doors, shutters, etc. (metal)	[1] 12	36	71
Cement	34	45	67
Fabricated structural and reinforcing steel [2]	[1] 23	35	64
Brick and clay products	20	34	61
Lumber and timber products	25	38	56
Elevators and equipment	24	27	48
Marble, granite, and other stone	[1] 28	29	41

[1] 1933 production estimated.

[2] 1929 production estimated.

Source: *Biennial Census of Manufactures.* For sand and gravel and crushed stone, *Minerals Yearbook.*

It can be inferred from table 21 that, contrasted with orders on usual types of private construction, orders on projects financed wholly or partially form Federal funds may have a greater relative effect on some building supply industries than on others. This conclusion is borne out by a comparison of the distribution of material orders per 1,000 dollars of construction value for all classes of construction and for PWA and regular Federal projects. The best figures available for all classes of construction are those for 1929 in the *Fifteenth Census (1930), Construction Industry.* Material orders purchased on projects financed wholly or partially from Federal funds were taken as percent of PWA reported project costs and of estimated total costs of regular Federal construction. In all of these comparisons there is a possibility of error because of differences in classifications of the various building materials; however, these discrepancies seem to be minor. A more important qualification lies in the fact that the constituent materials within the same class of construction may vary in different periods; there has been, for example, a decline recently in the use of brick. Since the figures for "all construction" refer to 1929, this qualification may be of some importance.

Table 22 shows the distribution of material orders per 1,000 dollars of construction value for various classes of construction. The explanation for the difference in material orders lies primarily in the types of construction represented by the different project classes. Private construction concentrates on commercial and residential buildings, hence the larger proportion of orders for brick, lumber, plumbing supplies, and paint. Public construction, on the other hand, consists chiefly of highways, sewers, bridges, dams, pumping and filtration plants, in addition to nonresidential buildings. This explains the more extensive use of cement, concrete products, cast-iron pipe and fittings, structural steel, sand, gravel, and crushed stone, and the much smaller use of brick, lumber, elevators, plumbing, and heating equipment.

TABLE 22.—*Estimated orders of specific building materials per $1,000 of construction value on PWA and regular Federal construction 1933–38, and on all construction in 1929*

[In dollars]

	Material orders per $1,000 of construction value			Difference from all construction per $1,000	
	All construction 1929	PWA financed construction 1933–38	Regular Federal construction 1934–38	PWA financed	Regular Federal
Lumber and millwork	44.63	32.54	19.39	−12.09	−25.24
Brick, tile, and clay products	28.95	20.08	3.22	−8.87	−25.73
Cut stone, granite, and marble	11.94	10.42	6.98	−1.52	−4.96
Sand, gravel, crushed stone	44.79	40.29	48.33	−4.50	+3.54
Cement	38.34	49.80	53.17	+11.46	+14.93
Concrete products	[1] 9.51	18.09	3.76	+8.58	−5.75
Cast-iron pipe and fittings	9.05	15.25	2.69	+6.20	−6.36
Structural and reinforcing steel	47.74	51.73	38.13	+3.99	−9.61
Plumbing supplies	35.70	10.53	3.22	−25.17	−32.48
Doors, windows, trimmings (metal)	4.77	6.47	4.83	+1.70	+.06
Elevators	14.05	2.65	2.69	−11.40	−11.36
Paint	9.16	.21	1.07	−8.95	−8.09
Heating and ventilating equipment	34.10	15.40	4.83	−18.70	−29.27

[1] Includes concrete, cinder block, and ready-mixed concrete.

Source: For all construction, *Fifteenth Census of the U. S.* (1930), "Construction Industry," pp. 27, 120. For PWA, material orders as reported by the Bureau of Labor Statistics were taken as percent of total reported project costs. For regular Federal construction, material orders as reported by the Bureau of Labor Statistics were taken as percent of estimated total costs; these material orders and estimated total costs cover only contracts awarded after July 1, 1934, and include Federal-aid highways.

Further information concerning the business-stimulating effects of public works could be drawn from a consideration of movements in capacity during recent years. Unfortunately, with a few exceptions, statistics on capacity are not available for construction supply industries. The principal exception is the cement industry, for which ample current data are available; for heavy structural shapes capacity estimates are available for the years since 1933, and for brick and tile up to 1935. Table 23 shows the production of each of these materials expressed as percent of capacity, and indexes of total capacity. It will be observed that in no year did total cement capacity fall below the 1929 figure, despite the fact that production as percent of capacity declined to 23.5 in 1933 and recovered to only 45.2 in 1937. Similarly, brick and tile capacity was consistently above the 1929 level up through 1934 and in 1935 declined to only 99.3, although production as percent of capacity was only 8.9 in 1933 and 15.5 in 1935. The production capacity for heavy structural shapes shows a steady decline from 100 in 1933 to 85.3 in 1938. However, actual production at no time approached the capacity level, the highest point being 52.5 percent of capacity in 1937. In 1938, production declined again to 29.8 percent.

Although there are no statistics with respect to the capacities of other construction supply industries, we can perhaps assume that in no case have capacity levels been approached by output. However, it should be noted that construction industries are for the most part extremely seasonal and, consequently, a comparatively low ratio of production to capacity is to be expected over an annual period.

The probability that output in construction supply industries has not approached the levels of capacity,

TABLE 23.—*Production as percent of capacity and index of total capacity, for 3 building materials*

Year	Portland cement		Brick and tile		Heavy structural shapes	
	Production as percent of capacity	Index of total capacity (1929=100)	Production as percent of capacity	Index of total capacity (1929=100)	Production as percent of capacity	Index of total capacity (1933=100)
1929	67.2	100.0	47.2	100.0	----------	----------
1930	62.2	102.2	31.5	101.6	----------	----------
1931	47.1	104.4	18.0	102.8	----------	----------
1932	28.3	106.8	10.6	103.2	----------	----------
1933	23.5	106.4	8.9	102.5	16.0	100.0
1934	28.9	106.1	11.1	102.7	21.0	99.6
1935	28.5	105.9	15.5	99.3	24.4	99.6
1936	42.3	104.8	----------	----------	42.8	95.6
1937	45.2	101.8	----------	----------	52.5	86.8
1938	40.9	101.9	----------	----------	29.8	85.3

Sources: For cement, the *Survey of Current Business;* for brick and tile, *Productivity and Employment in Brick and Tile*, a National Research Project published by the Works Progress Administration, February 1939; for heavy structural shapes, *Annual Statistical Reports* of the American Iron and Steel Institute, 1934–38.

except possibly for very short seasonal periods, possesses considerable relevance for the evaluation of the secondary and tertiary effects of public works expenditures. It makes it quite unlikely that public works expenditures have induced any significant volume of new capital investment in construction supply industries. On the other hand, it would seem equally improbable that the capacities of the cement industry and of the brick and tile industry would have been maintained at a level approximately that of 1929, had it not been for the heavy purchases on construction projects financed wholly or partially from Federal funds. On this very limited evidence one might perhaps conclude that Federal construction expenditures, while probably not inducing any new investment in construction industries, have nevertheless been a factor in stimulating expenditures for the maintenance of capital equipment.

Relation of Federal Public Works Expenditure to Other Construction

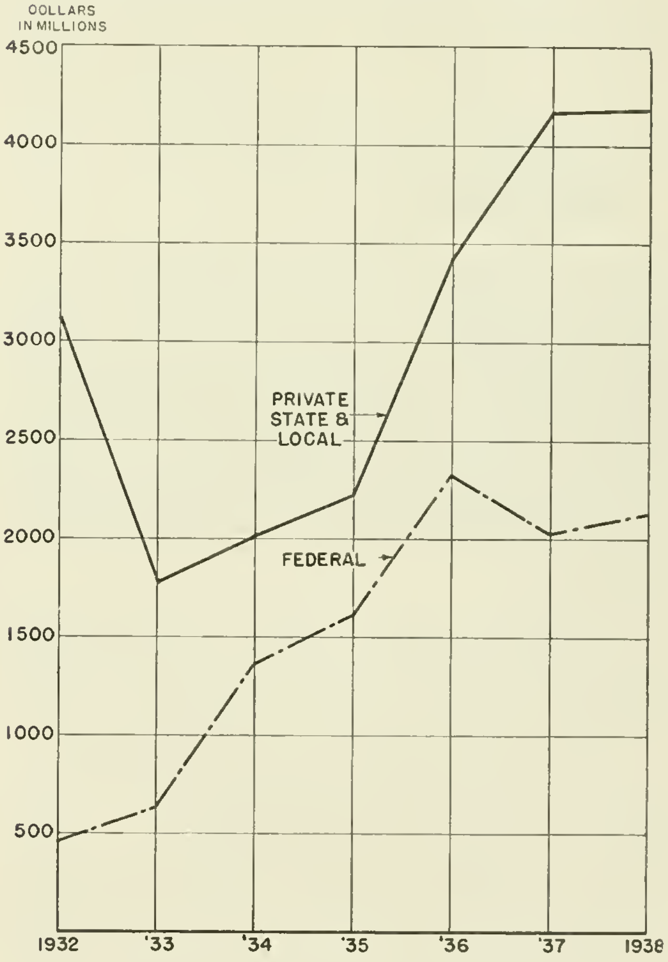
The approach to the emergency Federal public works expenditure program of 1933 was more or less based on the idea that the volume of public works construction should be manipulated in a manner compensatory to movements in the volume of private construction. The objective was a volume of public works construction large in the depression and early recovery period, and tapering off gradually as private activity increased. One difficulty which the application of this idea has encountered has already been mentioned, namely, the perverse trend of state and local construction expenditures, which up to 1933 constituted by far the greater proportion of public works expenditure. In the years 1931 to 1933, as we have seen, public works construction activity showed a substantial cyclical decline because of the contraction of state and local activity; and since 1933 the Federal Government has been forced to take the lead in generating a countercyclical trend. It has attempted to do this partly by direct Federal projects and partly by the use of grants and loans to State and local governments for projects to be conducted under their auspices.

With respect to the experience of recent years there are two primary observations relevant to a cyclical analysis of federally financed construction activity. In the first place, the sharp decline in private and State and local construction following 1929–30 clearly called for a large and rapid expansion of Federal activity if compensatory action was the objective. In the years 1931–33, as we have seen, a substantial rise did occur, but it was inadequate to offset even the drop in State and local activity. By far the largest increase in federally financed activity occurred in the years 1934 and, in particular, 1936, and a high level was maintained in 1937 and 1938. The peak in federally financed activity was reached some 3 years after the low point in other construction had occurred. Figure 19 places the annual volumes of Federal expenditures for construction in relation to private and State and local construction expenditures for 1932–38. Figure 20 shows aggregate orders of five construction materials on projects financed wholly or partially from Federal funds as compared to estimated total production of those materials. These charts illustrate clearly the lag in the countercyclical timing of Federal construction in recent years. The lag was much shorter in the case of PWA construction alone, than it was considering Federal public works activity as a whole.

The second observation is that at no time since 1930 has private, state, and local construction approached a level comparable either to predepression volumes or to the presumed current capacities of construction industries. For that reason the entire period can be considered a depressed one for private construction. Further-

FIG. 19

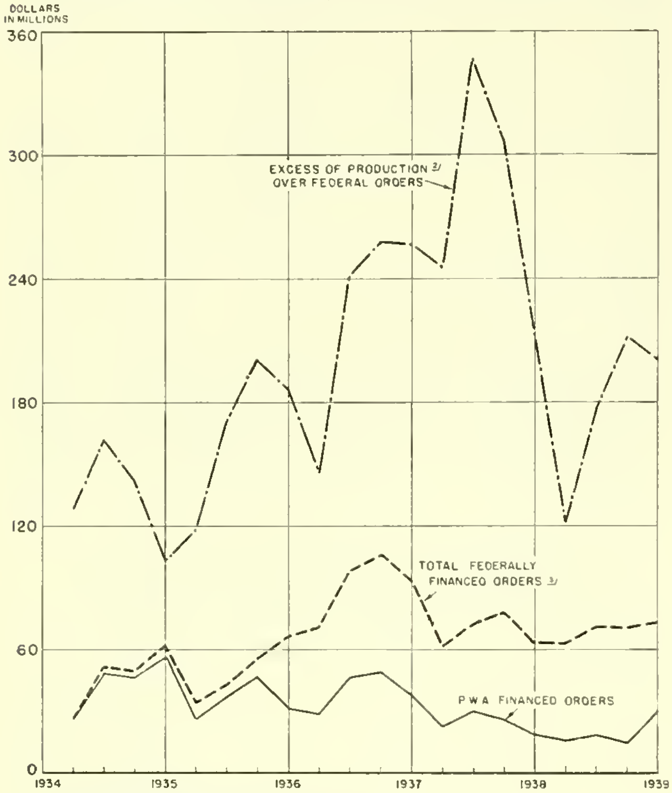
COMPARISON OF FEDERAL CONSTRUCTION EXPENDITURES WITH PRIVATE, STATE AND LOCAL EXPENDITURES. 1932 - 38



NOTE : FEDERAL CATEGORY INCLUDES WORK RELIEF CONSTRUCTION
SOURCE : SEE TABLES 1 AND 2

FIG 20

MATERIAL ORDERS ON PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS, COMPARED WITH ESTIMATED AGGREGATE PRODUCTION LESS FEDERAL ORDERS, FOR FIVE CONSTRUCTION MATERIALS,1/ 1934 - 1938



1/ LUMBER AND TIMBER PRODUCTS, BRICK AND CLAY PRODUCTS, CEMENT, CAST IRON PIPE AND FITTINGS AND FABRICATED STRUCTURAL AND REINFORCING STEEL
2/ INCLUDES ESTIMATED DELIVERY COSTS
3/ ONLY COVERS CONTRACTS AWARDED AFTER JULY 1, 1934, EXCEPT PWA PROJECTS AND RFC PROJECTS (AFTER MARCH 15, 1934)
SOURCE: SEE APPENDIX C

more, a large margin of unemployed human and material resources existed outside as well as within the construction industries. At no time did the general economy reach that stage of near-full employment where for reasons of employment or business stability a countercyclical contraction of public activity was clearly called for.[4] The important question has not been the movements in Federal activity, but the appropriate volume of public works for the whole depressed period.

Summary

The relation between public works expenditure and the level of business activity is a many-sided problem; it is not an easy task to tie the various aspects of the problem as just covered into one single statement.

It is to be noted first of all that we have been concerned only with the statistically identifiable effect of public works expenditure on national income. We have limited discussion to the effect of public works expenditure on the level of activity in the construction industry and in those industries engaged in supplying materials for the works. This is not all of the income-increasing effect, for the workers spend wages which they would not otherwise have, and those engaged in supplying materials also have wages, salaries, or profits at their disposal which otherwise they would not have. These further effects are no less real because they cannot be measured.[5]

As a matter of general perspective, the scale of public works activity in the United States must not be overestimated. After 1930 public construction expenditure declined, and not until 1936 did it recover its predepression level. If work relief construction is excluded, public construction has not to date regained the 1925–29 level. The greatest range in public construction expenditure of all kinds during the period was from $1,354,000,000 in 1933 to $3,228,000,000 in 1938, or a change of $1,874,000,000. The greatest change from one year to the next was between 1935 and 1936, when public construction expenditure increased from $1,850,000,000 to $3,216,000,000, or by $1,366,000,000. Changes in public construction expenditure of from one to two billions are undoubtedly important but, even conceding a maximum effect, present levels of public construction expenditure cannot be considered the major determinant of the level of business activity and national income. In saying this it is important to add that, on the other hand, there is no other single element of public or private policy which, operating by itself, is a major determinant; the determination of the national income is the product of many variables. No single one is by itself determining, but no one can for that reason alone be ignored.

Related to the construction industry specifically, the showing of public construction expenditure is naturally more impressive. This industry, which was an important avenue for investment expenditure during the 1920's, showed an extremely heavy slump during the 1930's. Public works expenditure also declined by half between 1930 and 1933 but, whereas it accounted for only 21.6 percent of total construction in 1925–29, including work relief construction, it accounted for more than half of all construction in 1933 and in subsequent years, with the exception of 1937. In the period from 1933 on, public construction has been the major factor in the construction industry and a major factor in such recovery as this industry has made from the 1933 low. It has provided support to the economy where declining private investment left the greatest gap. It has not been sufficient, however, to restore predepression levels of construction investment.

Within the category of public construction, Federal expenditures on the one hand and State and local on the other have shown widely divergent trends. Federal expenditures increased from an average of $188 millions in 1925–29 to $843 millions in 1933–38, excluding work relief, and $1,630 millions including work relief. This manifold rise, however, was offset, in a degree depending upon whether or not work relief is included, by the persistently low level of State and local expenditures, which were $822 millions in 1933–38 as compared with $2,104 millions in 1925–29.

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[4] Contraction of public works expenditure on grounds of employment and capacity might be justified could it be shown that this industry is overexpanded or declining. It is here assumed, rightly or wrongly, that this is not the case.

[5] For more complete discussion of this, see appendix B.

Tracing the effect of public construction expenditure (including work relief) back to individual industries supplying materials, one naturally finds a wide variation in effect. Construction supply industries were, inevitably, deeply affected by the depression, and it is apparent that some of the more important of them have been very largely dependent on public works orders. Orders on construction financed wholly or partially from Federal funds appear regularly to have accounted for 30 to 60 percent of the output of the cement industry and of important branches of the steel industry, with only slightly smaller percentages holding for industries furnishing sand, gravel, and other bulk construction materials. Federally financed orders have provided a smaller but significant part of the business of a considerable number of other industries.

From limited evidence it would appear that withdrawals from inventories have not been important. Such changes as have occurred would serve to delay the effect of the program when stocks were depleted or to advance the effect when stocks were raised to a higher level. But the changes in stocks in the relevant industries were comparatively small over the period. For the less specialized construction materials inventory changes may have had a more important effect than in the case of the specialized construction materials here analyzed.

CHAPTER IV—FEDERAL CONSTRUCTION AND EMPLOYMENT[1]

The chief concern of governmental and private agencies since the beginning of the depression has been the high level of unemployment that has characterized the entire period. The basic objective of public action has been the solution or alleviation of this problem. While unemployment has been but one aspect of the inadequate utilization of human and material resources, the low level of income, and the general deep-seated dislocations in our economy, nevertheless it is the most prominent and, from the standpoint of social policy, the most urgent of the problems which have accompanied recent economic developments. The relation of public construction activity to the level of employment constitutes, therefore, a subject for inquiry of primary interest and significance in any attempt to analyze the past and potential contribution of expenditures for public works to economic activity and welfare.

This chapter attempts to examine this relationship by determining the volume of on-site and off-site employment which has been supplied by the various types of construction financed from Federal funds, and by relating this employment to the level of unemployment during the years 1933–38. Employment on federally financed construction by regions will also be compared with estimates of regional unemployment and population. Finally, the relative costs per unit of employment, the "employment-efficiencies," of specific programs and project types will be examined.

The program of the Federal Government since 1933 has involved two general types of construction activity. The first type is construction in the ordinary sense of the term and shares, in large part, the characteristics of private construction. This type of construction has been conducted by the several Federal departments from regular appropriations, and by State governments from Federal-aid highway grants. While these two activities may be called the "normal" activities of the Federal Government, because they were in operation for some years prior to the depression, their volume has been affected by the need for creating employment. In addition, the Federal Government has financed construction activity, in the usual sense of the term, through PWA grants and loans to States and localities, through PWA allocations to various Federal departments, through RFC loans to States and private enterprise, and through allocations to Federal agencies from relief appropriations. These last constitute "Federal Projects Under the Works Program." They are not WPA projects, but are conducted directly by the Federal department or agency receiving the funds. Since the latter part of 1938 the Federal Government has also financed residential construction through USHA loans.

The second category of construction activity undertaken by the Federal Government has been work relief. Some of the projects generally included within the meaning of that term fall outside the classification of construction activity, and many of the remainder are only in part construction. Work relief construction was carried on through the CWA from November 1933 to May 1934, the FERA from April 1934 to the end of 1935, and the WPA after August 1935.[2] In the subsequent discussion of work relief, only that part which has been estimated by the WPA Division of Statistics to consist of construction proper will be included. In all categories of regular construction and work relief, maintenance work is excluded insofar as possible.

There are two principal differences between public works projects and work relief projects. First, work relief construction has been primarily (but by no means exclusively) of a light nature requiring relatively small amounts of equipment and materials and a large proportion of unskilled labor. Public works projects, on the other hand, have included all classes of construction, many of them requiring substantial amounts of equipment, materials, and skilled labor. Secondly, work relief construction has provided a very much larger volume of employment on the construction site (on-site employment) per dollar of cost than have public works projects. This has resulted partly from the light nature and small material requirements of work relief projects but partly, also, from the vigorous attempts by those in charge to afford through work relief as many on-site jobs as possible.

This chapter will attempt to measure both the employment at the site of construction and the employment directly attributable to the construction project but which is provided away from the site, primarily in the manufacture and transportation of the materials. On-site and off-site employment together constitute the identifiable effect of public construction on the volume of employment. They do not constitute the total effect of such construction, since additional employment is generated by the expenditure of the wages and incomes received by those engaged in construction or the supplying of materials. These further effects are not statistically identifiable and are treated qualitatively in appendix B.

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[1] All data on unemployment, employment on private construction, and employment on public construction except at the site of construction, are estimates and must be read as such. Much of the material on which this chapter is based has been collected and assembled in the Division of Construction and Public Employment of the Bureau of Labor Statistics, under the supervision of Mr. Herman B. Byer.

[2] From May to November 1933, the Federal Government made grants to States from FERA funds to enable the continuation of work relief programs previously inaugurated by States and localities.

The measurement of on-site employment is relatively easy. It is available from records of the Bureau of Labor Statistics based on reports of contractors giving their employment by months on all PWA projects, and on projects financed from regular appropriations ("regular Federal construction") for which contracts were awarded after July 1, 1934. The Division of Statistics of the WPA has compiled estimates of the on-site employment on that part of work relief which has been classified as construction. However, the only available estimates of on-site employment on all public and private construction are those of the Works Progress Administration. In incorporating PWA and Federal employment into the total figures, the WPA Division of Statistics adjusts the Bureau of Labor Statistics figures of PWA and Federal employment to exclude certain items such as shipbuilding, railroad equipment, and limited-dividend housing projects.[3] In the tables comparing federally financed construction employment with total construction employment the WPA estimates will be used, whereas in the sections dealing with Federal and PWA employment alone, the unadjusted Bureau of Labor Statistics figures will be used.

The measurement of off-site employment is a more difficult matter. As noted above, off-site employment results from the purchase of materials used in construction and also from the administrative and other work required away from the site. However, approximate estimates of off-site employment can be made on the basis of detailed studies which have been undertaken by the Bureau of Labor Statistics. The nature of these studies will be explained more fully in a later section.

A further problem arises with respect to the unit of measurement of employment. In general the most satisfactory and easily understandable unit is the employee or the employee-year, and this will be used for the most part in the following sections. However, the actual number of days or hours worked in an employee-year may vary substantially. Consequently, the more accurate man-hour unit will be used in determining the ratios of off-site to on-site employment and the amount of employment per dollar of expenditure, "the employment efficiency," of different types of programs and projects.

On-Site Employment on New Construction, 1925–1938

Until the Federal Government entered the construction field with its emergency works activities in 1933, the various categories of construction employment were simple and well-defined. In addition to a large volume of employment on private and on State and local construction, there was a smaller amount of employment on normal Federal construction and on public roads financed jointly by the Federal and State governments. Beginning with 1933, however, additional categories of employment appear with the PWA allotments to Federal departments, the PWA grants and loans to States and localities, the RFC and USHA loans to States, localities, and private businesses, WPA projects involving some sponsor contributions, and Federal projects under the works program. In this section we shall follow, in general, a classification according to source of funds. In addition to the categories of construction employment for which the funds are supplied entirely by States and localities, the Federal Government, and private sources, there will be two additional categories, namely, employment on construction financed jointly by the Federal Government and by States or localities, and employment on work relief construction. Employment on RFC and USHA projects has been relatively insignificant in the period under consideration and has been included in the category of Federal construction. It should be emphasized again that these employment figures are estimates; also that they exclude employment on federally financed railroad equipment, shipbuilding, and limited-dividend housing projects.

Construction financed jointly by the Federal Government and States or localities comprises PWA non-Federal projects and Federal-aid highway projects. The only basis available for prorating this employment between the various governments is the proportion of the total funds which each contributed. In some cases it is quite possible that the construction would have been undertaken anyway by States and localities even if the Federal Government had not supplied part of the funds. In other cases the Federal funds provided the stimulus as well as the means for undertaking the projects. Employment on these projects, therefore, has been placed in a separate category.

Employment on work relief construction, as noted above, is not directly comparable with other types of construction employment, since it is generally of a somewhat different nature. Consequently, employment on work relief construction is also considered separately from other types of construction employment.

During the years from 1925 to 1929, on-site employment by all levels of government on public construction averaged 485,000 men per year, and employment on private construction averaged 1,780,000 men, or about four times as many. Federal public works accounted on the average for 40,000 men, and Federal-aid highway projects for 37,000. In terms of percentages, public works employment from 1925 to 1929 represented 21.4 percent of total construction employment; Federal employment constituted 1.8 percent of total construction employment and 8 percent of public construction employment, and employment on Federal-aid highways an approximately equivalent proportion. Table 1 and figure 1 give in detail the construction employment by sources of funds by years from 1925 to 1938, and table 2 and figures 2–A and 2–B show employment by sources of funds expressed as a percentage of total construction employment, including and excluding work relief. Table 3 shows the number of man-hours worked annually from 1935 to 1938 on the several programs of federally financed construction.

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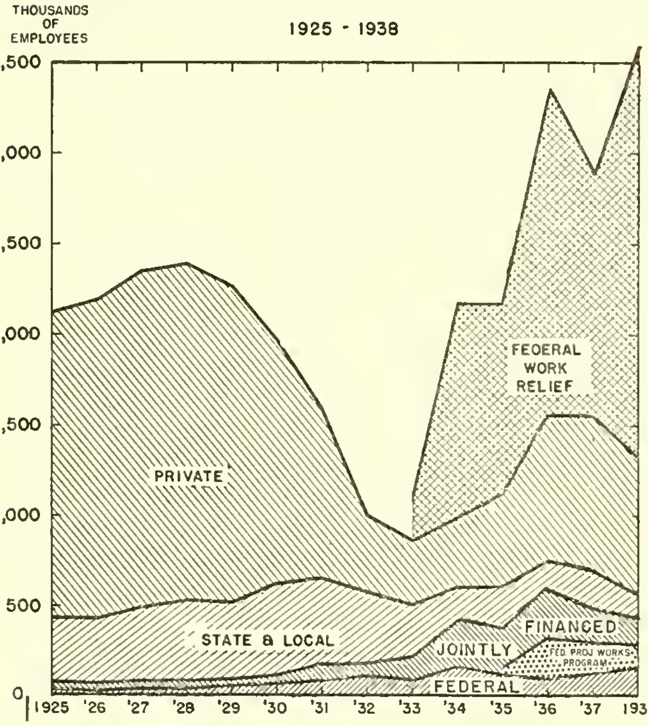
[3] Employment on limited-dividend housing is included in private residential construction employment.

After 1930 on-site employment on both State and local, and private construction, declined sharply; State and local employment dropped from 519,000 in 1930 to 292,000 in 1933, and private construction employment from 1,736,000 in 1929 to 348,000 in 1933. By 1937 private construction employment had recovered to only 876,000, or less than 50 percent of the predepression level, and the average for the 5 years, 1934 to 1938, was only 669,000 men. Employment on unaided State and local public works construction, however, showed a further substantial decline after 1933. The average employment for this class of work for the 5 years 1934–38 was 177,000 or 43 percent of the predepression level. At no time from 1934 to 1938 did unaided State and local employment reach as much as 75 percent of the 1933 level.

FIG. I

ESTIMATED ONSITE EMPLOYMENT ON NEW CONSTRUCTION BY SOURCES OF FUNDS[1]

1925 - 1938



[1] SHIP-BUILDING, RAILROAD EQUIPMENT PROJECTS, AND LIMITED DIVIDEND HOUSING PROJECTS ARE EXCLUDED FROM FEDERAL AND JOINTLY FINANCED CATEGORIES.

SOURCE: PETER A. STONE, CONSTRUCTION EXPENDITURES AND EMPLOYMENT, 1936-1938 AND 1925-1936, WORKS PROGRESS ADMINISTRATION

TABLE 1.—*Estimated on-site employment on new construction, by sources of funds, 1925–38*

[Thousands of employees]

Year	Federal funds: Regular Federal and PWA Federal construction[1]	Federal funds (ERA): Federal projects under works program	Jointly financed: PWA non-Federal construction and Federal-aid highways[1]	State and local funds	Total public funds	Private funds	Grand total	Including work relief construction: Work relief construction[2]	Including work relief construction: Total Federal	Including work relief construction: Total public	Including work relief construction: Grand total
Average, 1925–29	40	------	37	408	485	1,780	2,265	-----	-----	-----	-----
1925	34	------	38	364	436	1,689	2,125	-----	-----	-----	-----
1926	33	------	34	368	435	1,762	2,197	-----	-----	-----	-----
1927	37	------	36	420	493	1,859	2,352	-----	-----	-----	-----
1928	44	------	39	451	534	1,862	2,396	-----	-----	-----	-----
1929	53	------	38	438	529	1,736	2,265	-----	-----	-----	-----
1930	66	------	49	519	634	1,334	1,968	-----	-----	-----	-----
1931	89	------	94	472	655	938	1,593	-----	-----	-----	-----
1932	107	------	75	399	581	420	1,001	-----	-----	-----	-----
1933	97	------	124	292	513	348	861	246	343	759	1,107
1934	161	------	273	171	605	366	971	1,214	1,375	1,819	2,185
1935	115	[3] 37	223	216	591	533	1,124	1,025	1,177	1,616	2,149
1936	100	213	282	155	750	814	1,564	1,610	1,923	2,360	3,174
1937	127	167	192	213	699	876	1,575	1,144	1,438	1,843	2,719
1938	153	145	167	132	597	756	1,353	2,115	2,413	2,712	3,468
Average, 1934–38	131	[4] 112	227	177	648	669	1,317	1,422	1,665	2,070	2,739

[1] Employment on federally financed shipbuilding, railroad equipment, and limited-dividend housing projects is not included.

[2] Around 15 percent of funds for WPA projects have been provided from non-Federal sources.

[3] Only 5 months operation in 1935.

[4] 5-year average; 4-year average equals 141.

Source: Peter A. Stone, *Construction Expenditures and Employment, 1936–38, and 1925–36*, Works Progress Administration.

In contrast, employment on construction financed entirely by the Federal Government, and on that financed jointly by the Federal and State or local governments, shows a very different trend, as a result of the aggressive Federal works programs and of the availability of joint financing methods. In the years 1934–38, on-site employment on regular Federal and PWA Federal construction and on Federal projects under the works program averaged 243,000 or six times the 1925–29 level. Similarly, on-site employment on PWA non-Federal projects and on Federal-aid highways averaged 227,000 men in 1934–38, also a sixfold increase over the 1925–29 average for the same category. In terms of percentages, in the years 1934–38, employment on regular Federal, PWA Federal projects, and Federal projects under the works program constituted 18.4 percent of total construction employment, and that on projects jointly financed 17.2 percent, compared with 1.8 percent and 1.6 percent, respectively, in 1925–29. It is interesting to note that in 1934–38 almost as many men were employed on the

Table 2.—*Estimated on-site employment on new construction, by sources of funds, expressed as percent of on-site employment for all public and private constuction, 1925–38*

Year	Regular Federal and PWA Federal construction [1]	Federal projects under works program (ERA)	PWA non-Federal construction and Federal-aid highways [1]	State and local	Total public	Private	Including work-relief construction: Work relief [2]	Including work-relief construction: Total Federal	Including work-relief construction: Total public
Average, 1925–29	1.8	------	1.6	18.0	21.4	78.5	------	------	------
1925	1.6	------	1.8	17.1	20.5	79.5	------	------	------
1926	1.5	------	1.5	16.8	19.8	80.2	------	------	------
1927	1.6	------	1.5	17.9	21.0	79.0	------	------	------
1928	1.8	------	1.6	18.8	22.3	77.7	------	------	------
1929	2.3	------	1.7	19.3	23.4	76.7	------	------	------
1930	3.4	------	2.5	26.4	32.2	67.8	------	------	------
1931	5.6	------	5.9	29.6	41.1	58.9	------	------	------
1932	10.6	------	7.5	39.9	58.0	42.0	------	------	------
1933	11.3	------	14.4	33.9	59.6	40.4	22.2	31.0	68.6
1934	16.6	------	28.1	17.6	62.3	37.7	55.6	62.9	83.2
1935	10.2	[2] 3.3	19.8	19.2	52.6	47.4	47.7	54.8	75.2
1936	6.4	13.6	18.0	9.9	48.0	52.0	50.7	60.6	74.4
1937	8.1	10.6	12.2	13.5	44.4	55.6	42.1	52.9	67.8
1938	11.3	10.7	12.3	9.8	44.1	55.9	61.0	69.6	78.2
Average, 1934–38	9.9	[3] 8.5	17.2	13.5	49.2	50.8	51.9	60.8	75.6

[1] Employment on federally financed shipbuilding, railroad equipment, and limited-dividend housing projects is not included.

[2] Around 15 percent of funds for WPA projects have been provided from non-Federal sources. Only 5 months operation in 1935.

[3] 5-year average; 4-year average is 10.7.

Source: Peter A. Stone, *Construction Expenditures and Employment, 1936–38, and 1925–36.* Works Progress Administration.

Table 3.—*On-site man-hours worked on construction financed wholly or partially from Federal funds, 1933–38*

[Millions of man-hours]

Year	Regular Federal and PWA Federal	PWA non-Federal and Federal-aid highways	Federal projects under the works program	Work relief
1935	137.6	139.3	45.5	(1)
1936	129.7	302.7	279.7	2,442.2
1937	138.9	274.9	194.7	1,562.9
1938	152.9	249.1	161.7	2,572.7

[1] Complete figures not available.

Source: Bureau of Labor Statistics.

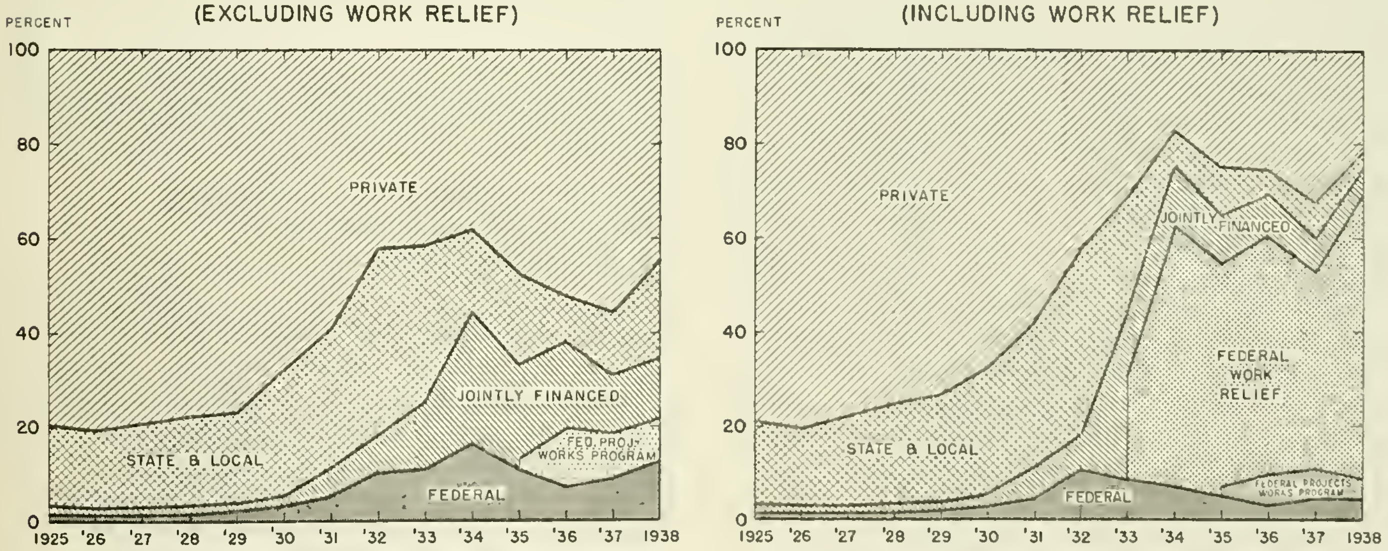
site of State and local construction plus jointly financed construction combined as in 1925–29.

Despite this substantial increase in on-site construction employment on projects financed wholly or partially from Federal funds, total employment on construction (excluding work relief) at no time has approached the 1925–29 level of 2,265,000 men. In 1937, the best year, total employment was only 1,575,000 men, and the average for the period 1934–38 was 1,317,000 men. Although the proportion of State and local employment declined from 18 to 13 percent, despite the lower level of total employment, the percentage which all public employment represented of total employment rose from 21 percent in 1925–29 to 49 percent in 1934–38.

The on-site construction employment picture from 1933 to 1938 is altered drastically if employment on

FIG. 2

ESTIMATED ONSITE CONSTRUCTION EMPLOYMENT BY SOURCES OF FUNDS, EXPRESSED AS PERCENT OF ONSITE EMPLOYMENT ON ALL CONSTRUCTION 1925-38



SOURCE: PETER A. STONE, CONSTRUCTION EXPENDITURES AND EMPLOYMENT, 1936-38, AND 1925-36, WORKS PROGRESS ADMINISTRATION work relief construction is also considered. The average number employed in 1933 on a yearly basis is low, 246,000, since the CWA program did not get under way until November. But in the years 1934 to 1938, employment on work relief construction averaged 1,422,000 men; the range was from 1,025,000 in 1935 to 2,115,000 in 1938. If we include this employment in the total of on-site construction employment, the 1934–38 average of the latter becomes 2,739,000 men—actually some 21 percent above the 1925–29 level. Furthermore, the average of federally financed employment becomes 1,665,000 men and of all public employment 2,070,000 men. Thus the relationship between public works employment, including work relief employment, and private employment was almost reversed as compared with the situation in the predepression period. Before the depression public employment represented 21.4 percent of all construction employment, and in 1934–38 it was 75.6 percent.

If one includes the large work relief programs, therefore, on-site construction employment was maintained at a relatively high level. Aside from the partly different character of work relief employment, however, there is the further factor of off-site employment to consider. It is in this latter field that ordinary construction provides the larger portion of its employment effects, and as the next section will indicate, work relief construction probably gives rise to no more than 10 percent as much off-site employment per on-site employee as does ordinary construction. Consequently, the total on-site and off-site employment attributable to construction was in 1934–38 nowhere near as great—even including work relief construction—as in 1925–29, although on-site employment was actually greater. Furthermore, in terms of the volume of construction activity, as the previous chapter showed, the contribution of the Federal Government has been on a far smaller scale in the depression and recovery period than the total on-site employment estimates (including work relief) would appear to indicate.

So far in this section we have been dealing with WPA estimates of total construction employment. Figure 3 and table 4 present the actual figures, taken from the records of the Bureau of Labor Statistics, of the on-site employment on projects financed in whole or in part from Federal funds, other than work relief. It will be observed that, in contrast to the WPA estimates, all PWA projects are covered, including railroad equipment, shipbuilding, and limited-dividend housing projects. In the following sections where off-site employment on Federal construction is considered, these Bureau of Labor Statistics figures will be used.

Table 5 and figure 4 give in detail the WPA estimates of work relief construction employment for 1933 to 1938. The much more rapid changes in the levels of work relief employment than in the PWA non-Federal employment show the greater flexibility of work relief projects.

TABLE 4.—*On-site employment on construction financed wholly or partially from Federal funds, excluding work relief, 1933–38* [1]

[In thousands of employees]

	PWA		Regular Federal		RFC	Federal projects under works program (ERA)	Total
	Federal [2]	Non-Federal [2]	Federal-aid highways	Other			
1933	[3] 59	[4] 4	85	76	[5] 5	----------	229
1934	363	113	3	38	[5] 17	----------	534
1935	218	140	7	42	12	[6] 37	456
1936	92	222	42	75	12	213	656
1937	47	140	59	119	6	167	538
1938	23	110	76	134	3	145	491

[1] Includes employment on PWA and Federal shipbuilding, railroad equipment, and limited-dividend housing projects.

[2] Employment on Federal low-cost housing projects has been deducted from the PWA non-Federal figures and added to PWA Federal employment.

[3] Yearly average of 6 months' employment; 6 months' average is 119.

[4] Yearly average of 4 months' employment; 4 months' average is 11.

[5] Estimated.

[6] Yearly average of 5 months' employment. 5 months' average is 88.

Source: Bureau of Labor Statistics' report, with exception of WPA estimates which were used for regular Federal and Federal-aid highways prior to 1935, and for Federal projects under the Works Program. Bureau of Labor Statistics reports represent yearly average of maximum number employed in any 1 week of each month.

TABLE 5.—*Estimated on-site employment on work relief construction, 1933–38*

[In thousands of employees]

Year	CWA	FERA	WPA	Total
1933	[1] 246	----------	----------	246
1934	[2] 611	[3] 603	----------	1,214
1935	----------	720	[4] 305	1,025
1936	----------	----------	1,610	1,610
1937	----------	----------	1,144	1,144
1938	----------	----------	2,115	2,115

[1] Yearly average of 2 months' employment; 2 months' average is 1,474.

[2] Yearly average of 5 months' employment; 5 months' average is 1,465.

[3] Yearly average of 9 months' employment; 9 months' average is 803.

[4] Yearly average of 5 months' employment; 5 months' average is 731.

Source: *Construction Expenditures and Employment*, Works Progress Administration.

Off-Site Employment on Construction Financed Wholly or Partially From Federal Funds

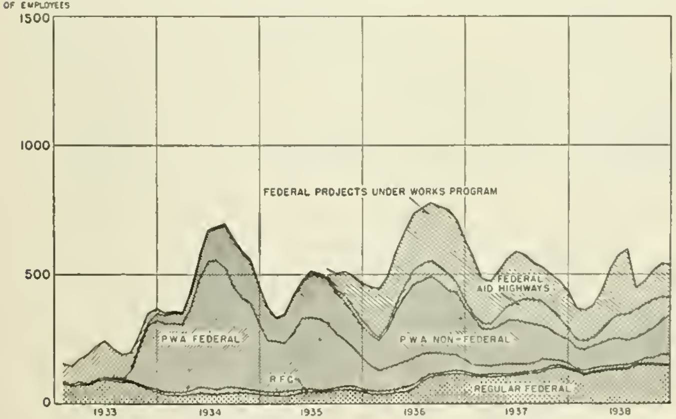
As stated above, the measurement of off-site employment is substantially more difficult than the measurement of on-site employment. However, by means of studies made by the Bureau of Labor Statistics during the past few years, general estimates of off-site employment (or, more correctly, maximum off-site employment) can be compiled. The Bureau of Labor Statistics has made careful and detailed studies of 8 types of construction materials showing, on a "cost accounting" basis, the amount of labor necessary to produce specific amounts of those materials. The use of a cost-accounting method means that the share, attributable to public works orders, of the aggregate employment in the specific construction supply industries is determined by the percentage which those orders constitute of total output. These analyses cover all the stages from raw material extraction to final fabrication and transportation to the site. The 8 materials analyzed accounted for about 58 percent of total material orders on projects financed by Federal funds.

In any appraisal of the relationship of public works construction to employment, it is of course necessary to include the off-site as well as the on-site labor. However, before proceeding to the detailed calculations, it should be emphasized that the off-site estimates must always be used with caution. It is doubtful if the ratios of off-site employment reflect accurately, in any one time period, the actual labor required to administer the projects and to supply materials for public works construction. The required off-site labor will vary not only with the volume of material orders and the size of the project but also with the productivity of labor in the supply industries. Productivity in specific factories changes substantially from year to year, not so much as a result of technological developments, as from the changing relationship of production to capacity.

Two studies which have been made by the Bureau of Labor Statistics illustrate the importance of the labor productivity and capacity variables. Table 6 presents an index of labor productivity in cement mills from 1925–34. In every year from 1925 to 1931 an increase in output per man-hour occurred, and in 1934 productivity per worker was 47.9 percent greater than in 1925. Table 7 shows the variations in man-hours required to manufacture a ton of finished steel products at different operating levels. Thus, when a plant is operating at 20 to 25 percent of capacity, 35 percent more man-hours are required for manufacturing 1 ton of finished steel products than when the plant is operating at 55 to 60 percent of capacity, and 147 percent more man-hours were required in administration. These two studies indicate the possible errors involved in formulating ratios by means of a cost accounting procedure and on the basis of studies covering specific time situations.

FIG 3

TOTAL ONSITE EMPLOYMENT ON CONSTRUCTION FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS,[1] EXCLUSIVE OF WORK RELIEF CONSTRUCTION 1933 – 1938



[1] INCLUDES EMPLOYMENT ON PWA AND FEDERAL SHIPBUILDING, RAILROAD EQUIPMENT AND LIMITED DIVIDEND HOUSING PROJECTS

SOURCE BUREAU OF LABOR STATISTICS, WITH EXCEPTION OF WPA ESTIMATES WHICH WERE USED FOR REGULAR FEDERAL AND FEDERAL AID HIGHWAYS PRIOR TO 1935 AND FEDERAL PROJECTS UNDER WORKS PROGRAM

TABLE 6.—*Labor productivity in cement mills, 1925–34*

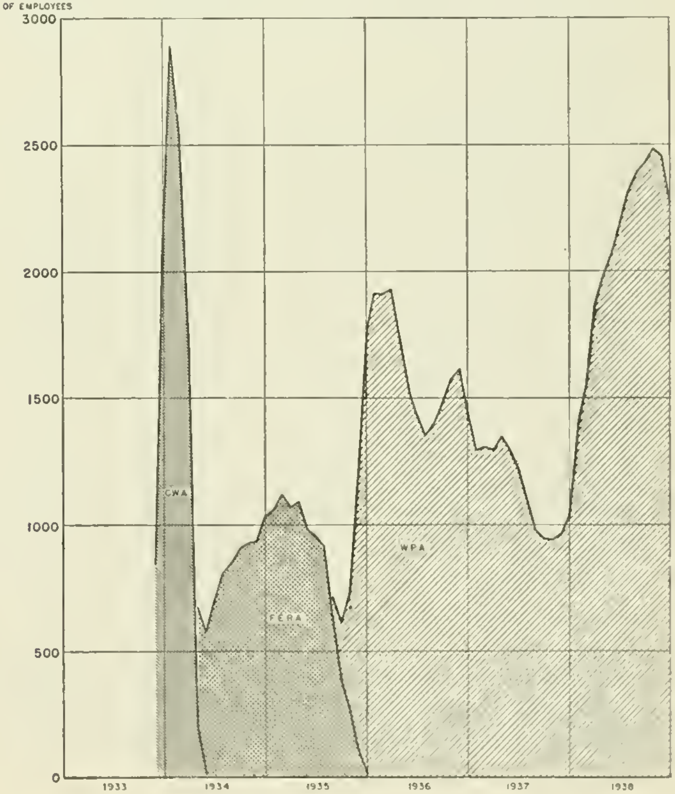
Year	Number of plants	Average man-hours per 100 barrels	Production (barrels per 100 man-hours)	Index of labor productivity
1925	122	61. 1	164	100. 0
1926	127	58. 7	170	104. 1
1927	136	54. 1	185	112. 9
1928	139	50. 3	200	121. 5
1929	126	47. 6	211	128. 4
1930	119	44. 8	223	136. 4
1931	109	41. 4	241	147. 6
1932	106	43. 1	233	141. 8
1933	98	42. 6	236	143. 4
1934	109	41. 3	242	147. 9

Source: B. H. Topkis, "Labor Requirements in Cement Production," *Monthly Labor Review*, March 1936.

Furthermore, the number of additional workers, as distinct from man-hours, is influenced by the existing volume of part-time employment, which is characteristically large at low levels of production. When a

FIG 4

ESTIMATED ONSITE EMPLOYMENT ON WORK RELIEF CONSTRUCTION, 1933-1938



URCE: CONSTRUCTION EXPENDITURES AND EMPLOYMENT, 1925 - 1936, AND 1936 - 1938, WPA

TABLE 7.—*Variations in man-hours required in manufacturing a gross ton of finished steel products at specified rates of plant operating capacity.*

[Average for all finished steel products]

Percent of total plant capacity	Actual average man-hours		Index of man-hours required	
	Manufacture	Administration	Manufacture	Administration
55–60	34.43	1.32	100	100
50–55	36.15	1.47	105	111
45–50	38.22	1.73	111	131
40–45	40.63	1.94	118	147
35–40	42.34	2.25	123	170
30–35	43.73	2.65	127	201
25–30	45.10	2.92	131	221
20–25	46.48	3.26	135	247

Source: "Man-hours of Labor per Unit of Output in Steel Manufacture," *Monthly Labor Review*, May 1935.

factory is working at 30 percent of capacity, a 25 percent rise in production might involve no additional workers at all, and it might require a far less than proportionate rise in man-hours. As noted, the Bureau of Labor Statistics studies are based on a cost accounting procedure—the volume of employment in construction supply industries is prorated according to the share of the total volume of business represented by government orders. This probably is the only practicable method of making the estimates. However, in many cases, an accurate appraisal would require that a marginal analysis be used; given the existing volume of employment, it would be necessary to estimate the further employment generated by an increase in orders as a result of public works.

The calculations of off-site man-hours, therefore, may somewhat overstate the actual increase in man-hours worked in construction supply industries as a result of public works orders. Furthermore, the estimates of off-site employees as distinct from man-hours involve an additional error in that the current volume of part-time employment is not taken into consideration. Consequently, the actual number of persons given employment may well have been less than proportionate to the increase in man-hours. Finally, the possibility that substantial withdrawals from inventories may obviate, for a short interval, any increase in production to meet material orders, casts additional doubt on the accuracy of these estimates in any specific time period. This factor probably does not affect the estimates over a period of years. The estimates should be considered to represent the maximum volume of on-site and off-site employment which may have resulted from Federal construction activity. Over a period of time the estimates will be more reliable than they are as a statement of the off-site employment resulting from any given order or project.

With these qualifications in mind, we turn now to the calculation of off-site employment. The Bureau of Labor Statistics has made special studies of 8 specific building materials showing the number of off-site man-hours provided per million dollars of orders. These estimates have been used in calculating the number of off-site man-hours provided by the total orders of the 8 materials on projects financed in whole or in part from Federal funds. For the materials not covered in these studies, an average of the 8 materials covered, weighted by the total Federal orders of the respective materials, was used. In addition, however, to the man-hours of work provided in the extraction, fabrication, and transportation of materials, public works construction provides employment in contractors' offices and, in the case of non-Federal projects, in sponsors' offices. Included in the total off-site man-hours, therefore, are estimates of this off-site administrative labor, the estimates being based on a special study by the Bureau of Labor Statistics.

Relating these estimates of total off-site man-hours to the known volume of on-site man-hours, we arrive at over-all ratios of off-site to on-site employment for the various construction programs. Taking the period 1933 to 1938 as a whole, off-site man-hours have been 2.0 times on-site man-hours in the case of non-Federal PWA programs, and 1.0 times in the case of Federal PWA programs. Similarly, the estimated ratio of off-site to on-site employment is 1.5 for RFC projects, 1.0 for regular Federal construction, 0.6 for Federal proj-

TABLE 8.—*Estimated off-site employment on construction financed wholly or partially from Federal funds, 1933–38*

SUMMARY TABLE

[In millions of man-hours]

	On-site man-hours	Off-site man-hours			Total man-hours	Ratio off-site and on-site
		Labor	Administrative	Total		
PWA:						
Federal	949	868	102	970	1,919	[1] 1.0
Non-Federal [2]	754	1,266	273	1,539	2,293	2.0
Regular Federal [3]	884	818	112	930	1,814	1.0
RFC [4]	79	97	20	117	196	1.5
WPA	9,748	917	[5] 606	1,523	11,271	.16
Federal projects under the works program	961	351	230	581	1,542	.6
FERA	926	108	36	144	1,070	.16
CWA	1,140	106	35	141	1,281	.12
Total	15,441	4,531	1,414	5,945	21,386	

[1] The ratio for the 1938 PWA Federal program, which had just gotten under way by the end of 1938, is estimated to be 1.7.

[2] Includes railroad equipment orders amounting to $62,800,000, for which there is no on-site labor.

[3] Covers only contracts awarded after July 1, 1934; includes Federal-aid highways.

[4] Covers only contracts awarded after Mar. 15, 1934.

[5] Covers rentals and services.

Source: See table 9.

ects under the works program 0.16 for WPA projects, 0.12 for CWA projects, and 0.16 for FERA projects. The data are presented in summary form in table 8 and the more detailed calculations are given in table 9.

The limited application of these ratios should be constantly kept in mind. In the first place, they are directly linked to the project composition of the individual programs in the years under discussion. Consequently, they apply only to the programs as they operated in the period 1933 to 1938. Should the project composition of, for example, a future non-Federal PWA program be substantially different from the past programs, the off-site ratio for the program as a whole will alter also. The important factors are the amount and kind of materials ordered, and these vary with different types of projects, as will be indicated in a later section.

This is well illustrated by a comparison of the Federal and non-Federal PWA ratios in the period 1933 to 1938. The considerably lower ratio on the Federal PWA projects arises primarily from the fact that the NIRA Federal program was concentrated in project types which provided large amounts of on-site employment rapidly. Thus, in the case of the 1938 PWA Federal

TABLE 9.—*Estimated off-site man-hours on construction financed wholly or partially from Federal funds, calculated from Bureau of Labor Statistics studies of individual materials*

	Material orders (In millions of dollars)								Cost per off-site man-hour [2] (In dollars)	Off-site man-hours (In millions)							
	PWA		Regular Federal	RFC	WPA	Federal projects under the works program	CWA [1]	FERA [1]		PWA		Regular Federal	RFC	WPA	Federal projects under the works program	CWA	FERA
	Federal	Non-Federal								Federal	Non-Federal						
Lumber products	39.0	97.4	36.1	3.3	96.0	32.6	11.8	16.0	0.85	45.9	114.6	42.5	3.9	112.9	38.3	13.9	18.8
Brick and clay products	16.2	57.7	6.1	.5	42.1	3.6	5.6	9.6	1.11	14.6	52.0	5.5	.5	37.9	3.2	5.0	8.6
Cement	146.8	61.9	98.7	12.4	85.5	42.9	7.9	11.0	1.52	96.6	40.7	64.9	8.2	56.3	28.2	5.1	7.2
Sand and gravel	75.3	37.2	54.6	1.8	63.9	19.6	-------	-------	1.00	75.3	37.2	54.6	1.8	63.9	19.6	-------	-------
Heating and ventilating equipment	18.5	46.1	8.5	.4	8.5	1.9	-------	-------	1.25	14.8	36.9	6.8	.3	6.8	1.5	-------	-------
Iron and steel	162.0	363.0	142.2	34.7	156.9	85.5	10.1	13.8	.74	218.9	490.5	192.2	46.9	212.0	115.5	13.6	18.6
Plumbing supplies	8.4	35.8	6.2	.4	12.1	4 3	5.7	4.7	1.28	6.6	28.0	4.8	.3	9.5	3.3	4.5	3.7
Electrical products	49.5	96.2	110.1	6.6	17.7	16.5	-------	-------	1.54	32.1	62.5	71.5	4.3	11.5	10.7	-------	-------
Railroad equipment orders	-------	62.8	-------	-------	-------	-------	-------	-------	[3] .87	-------	72.2	-------	-------	-------	-------	-------	-------
Total covered	515.7	858.1	462.5	60.1	482.7	206.4	41.0	55.1	10.16	504.8	934.6	442.8	66.2	510.8	220.3	42.1	56.9
Uncovered	388.7	354.7	401.6	33.3	436.9	139.5	68.4	54.3	[4] 1.07	363.3	331.5	375.3	31.1	408.3	130.4	63.9	50.7
Grand total	904.4	1,212.8	864.1	93.4	919.6	345.9	109.4	109.4	-------	868.0	1,266.0	818.0	97.0	919.1	351.0	106.0	108.0
Off-site administrative man-hours	-------	-------	-------	-------	-------	-------	-------	-------	-------	102.0	[5] 273.0	[5] 112.0	[5] 20.0	[6] 606.0	[7] 230.0	[8] 35.0	[8] 36.0
Total off-site	-------	-------	-------	-------	-------	-------	-------	-------	-------	970.0	1,539.0	930.0	117.0	152.5	581.0	141.0	144.0
Total on-site	-------	-------	-------	-------	-------	-------	-------	-------	-------	949.0	754.0	884.0	79.0	974.8	961.0	[9] 1,140.0	[9] 926.0
Ratio: off-site to on-site	-------	-------	-------	-------	-------	-------	-------	-------	-------	1.02	2.04	1.04	1.48	.16	.61	.12	.16

Ratio: Off-site man-hours to on-site man-hours =
1.02 PWA Federal.
2.04 PWA Non-Federal.
1.04 Regular Federal.
1.48 RFC.
.16 WPA.
.61 Works Program.
.12 CWA.
.16 FERA.

[1] From records of Works Progress Administration.

[2] As determined from Bureau of Labor Statistics' studies.

[3] The average cost per on-site man-hour for railroad equipment was estimated by giving the iron and steel cost per man-hour a weight of 3 and the heating and ventilating equipment cost a weight of 1.

[4] Average cost of 8 covered materials weighted by total Federal orders.

[5] The Bureau of Labor Statistics' estimates, of administrative man-hours per $1,000,000 of PWA contracts, 60.3 million for Federal and 105.6 million for non-Federal projects, were applied to the estimated expenditures on each of these programs. Sponsor hours were omitted in the PWA Federal and regular Federal estimates. See table 18 for source of expenditure figures except for RFC expenditures which were estimated by applying PWA percentages of total cost to known aggregates of pay-rolls and material purchases from January 1934 to December 1938 inclusive (21 percent of total cost added to pay-roll and material orders aggregates).

[6] Cost of rentals, services, etc., valued at $1 per man-hour.

[7] WPA ratio of off-site administrative man-hours to other off-site man-hours.

[8] An arbitrary figure of one-half the WPA ratio of off-site administrative man-hours to other off-site man-hours was used since certain elements included as rentals and services in WPA accounting were included in FERA and CWA material orders.

[9] On-site man-hours were estimated by multiplying the WPA estimates of average employment on CWA and FERA (in terms of employees) by the estimated average number of man-hours worked per year, namely 700 for FERA and 1,330 for CWA. These latter were calculated as follows: WPA records gave average man-hours worked monthly on FERA projects from April 1934 to April 1935; a yearly average of these figures was used for this entire program. For CWA projects sample studies were made, for the weeks ending Jan. 11, Feb. 22, and Mar. 15 (1933), of the distribution of employees working 15, 24, 30, and 39 hours per week. These distributions were applied respectively to the weekly number of employees in the periods Nov. 17 to Jan. 11, Feb. 22, and Feb. 23 to Apr. 26. The resulting estimtes of man-hours worked on the entire program amounted to 25.6 per week, 110.8 per month, and approximately 1,330 per year.

program alone, which is weighted heavily with building construction, it is estimated that the off-site ratio is about 1.7. By the judicious selection of projects, a program could be provided with any ratio from almost 0 to 4.0. The off-site ratios merely indicate the distribution of the total work provided between on-site labor and labor in factories, mines, transporatation, and offices. They do not measure the "employment-efficiency" or man-hour cost of the programs; these will be discussed in a later section.

The importance of project composition is further illustrated by the off-site ratio for the PWA non-Federal program estimated by the Bureau of Labor Statistics in 1936. This ratio was 2.5, or 25 percent in excess of the ratio presented above. The first PWA non-Federal program contained a substantial volume of railroad equipment orders for which there was practically no on-site employment. The earlier ratio is affected to a much greater degree by these orders than was the ratio for the programs covering the years 1933 to 1938.[4]

It should be noted that the amount of off-site employment provided by Federal projects is slightly understated, relative to the non-Federal projects, by the ratios given above. In the case of non-Federal projects the off-site man-hours provided in sponsors' offices are included, since the cost of that labor is included in the total cost of the project. In the case of Federal projects, however, this labor is provided by the Federal departments at their own expense and is not included either in the total costs of the projects or in the aggregate off-site man-hours.

The extremely low ratio of off-site to on-site labor on work relief construction, only one-thirteenth of that on non-Federal projects, reflects the emphasis on projects that provide a maximum of on-site labor and require a minimum of materials and equipment.

If these ratios are accepted as approximately correct for the individual programs in the period 1933–38 as a whole, the next step is to combine on-site and off-site employment on construction projects financed wholly or partially from Federal funds. This is done in table 10 and in figures 5 and 6, by applying the ratios to the volumes of on-site employment (in terms of number of employees rather than man-hours). It should be noted that the figures include all on-site and off-site employment resulting from PWA, regular Federal, and work relief projects, although some of the projects were only partly financed from Federal funds. A possibly substantial error is involved in applying the off-site man-hour ratios to on-site employment in terms of employees. This arises from the fact that the average number of hours worked per employee varies on the different programs. However, a reasonably accurate adjustment would be a complicated process, involving more refined data on the average man-hours worked per year in construction supply industries than is available; and the effort involved would be out of proportion to the general nature of the ratio estimates themselves. Consequently, the ratios have been applied to the employment figures without any adjustment. An additional error is involved in applying the ratios for the

Table 10.—*On-site and estimated off-site employment on construction projects financed wholly or partially from Federal funds, 1933–38*

[In thousands of employees]

	1933	1934	1935	1936	1937	1938	Average, 1934–38
PWA Federal:							
On-site [1]	[2] 59	363	218	92	47	23	149
Off-site	59	363	218	92	47	23	149
PWA Non-Federal:							
On-site [3]	[4] 4	113	140	222	140	110	145
Off-site	8	226	280	444	280	220	291
Federal projects under the Works Program:							
On-site	------	------	37	213	167	145	[5] 112
Off-site	------	------	23	130	102	88	[6] 69
Regular Federal:							
On-site [7]	161	41	49	117	178	210	119
Off-site	161	41	49	117	178	210	119
RFC:							
On-site	5	17	12	12	6	3	9
Off-site	8	26	18	18	9	5	14
Total excluding work relief:							
On-site	229	534	456	656	538	491	535
Off-site	236	656	588	801	616	546	641
Total	465	1,190	1,044	1,457	1,154	1,037	1,176
CWA and FERA:							
On-site	246	1,214	720	------	------	------	[8] 387
Off-site	34	170	101	------	------	------	[9] 54
WPA:							
On-site	------	------	305	1,610	1,144	2,115	[10] 1,035
Off-site	------	------	49	258	183	338	[11] 166
Total work relief:							
On-site	246	1,214	1,025	1,610	1,144	2,115	1,422
Off-site	34	170	150	258	183	338	220
Total	280	1,384	1,175	1,868	1,327	2,453	1,642
Grand total:							
On-site	475	1,748	1,481	2,266	1,682	2,606	1,957
Off-site	270	826	738	1,059	799	884	861
Total	745	2,574	2,219	3,325	2,481	3,490	2,818

[1] Total employment on all PWA Federal projects and Federal low-cost housing.
[2] Yearly average for 6 months' employment; 6 months' average is 118.
[3] Total employment on all PWA non-Federal projects.
[4] Yearly average of 3 months' employment; 3 months' average is 16.
[5] 5-year average for 4 years' employment; 4-year average is 141.
[6] 5-year average for 4 years' employment; 4-year average is 86.
[7] Includes Federal-aid highways.
[8] 5-year average for 2 years' employment; 2-year average is 967.
[9] 5-year average for 2 years' employment; 2-year average is 136.
[10] 5-year average for 4 years' employment; 4-year average is 1,294.
[11] 5-year average for 4 years' employment; 4-year average is 207.

Source: PWA, RFC, and regular Federal on-site employment figures are from Bureau of Labor Statistics records; Federal projects under the Works Program and work relief construction on-site employment figures are the WPA estimates (see tables 3 and 4). Off-site employment was estimated by applying the following ratios to on-site employment: PWA Federal, 1.0; PWA non-Federal, 2.0; regular Federal, 1.0; RFC, 1.5; WPA, 0.16; Federal projects under the Works Program, 0.61; CWA and FERA, 0.14.

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[4] Since 1936 the Bureau of Labor Statistics has made additional studies which provide the basis for a more accurate estimate at the present time.

period as a whole to the specific months or years within the period. As we have seen, the ratios vary from time to time as the project composition varies.

The estimated combined off-site and on-site employment on construction financed wholly or partially from Federal funds, excluding work relief, ranged from 465,000 men in 1933 to 1,457,000 in 1936. The average for the 5-year period, 1934 to 1938, was 1,176,000. On work relief projects, the range was from 280,000 in 1933 to 2,453,000 in 1938. The average from 1934 to 1938 was 1,642,000 men. It should be noted that the off-site employment resulting from material orders on work relief construction is not work relief employment, but is similar in nature to the employment provided by ordinary construction work.

Federally Financed Construction Employment and Unemployment

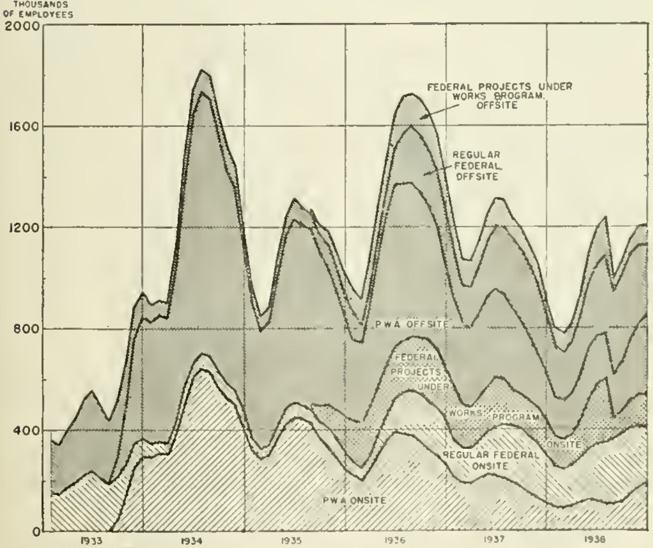
The first objective of expanded public construction in recent years has been reemployment of the unemployed; to relate employment on publicly financed construction to the volume of unemployment is therefore a useful way of placing public construction employment in perspective. Unfortunately, a comparison [5] of public works construction employment with unemployment is not easy. Official estimates of unemployment are not available on an annual or monthly basis. There are a number of estimates by nongovernmental agencies, but these differ substantially from time to time. Perhaps the most widely known and used of these is the series of the American Federation of Labor, and this will be used in the following sections, supplemented at times by the estimates of the National Industrial Conference Board. It is to be noted again that the estimates of employment on public construction, in particular the estimates of off-site employment, are also subject to the limitations explained in the preceding sections.

In table 11 total unemployment as estimated by the American Federation of Labor and the National Industrial Conference Board is compared, first with on-site employment, and second with combined on-site and estimated off-site employment on PWA and regular Federal construction from 1933–38. In table 12 the same data are presented for work relief construction. The unemployment series include not only totally unemployed persons but also relief workers. In order to compare construction employment with the number of unemployed, the on-site employment on work-relief construction has been subtracted in each year from the unemployed totals. In this way it can be said that total unemployment would have been increased by an amount roughly equivalent to total

FIG. 5

ONSITE AND ESTIMATED OFFSITE EMPLOYMENT ON CONSTRUCTION FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS,[1] EXCLUSIVE OF WORK RELIEF CONSTRUCTION

1933–1938



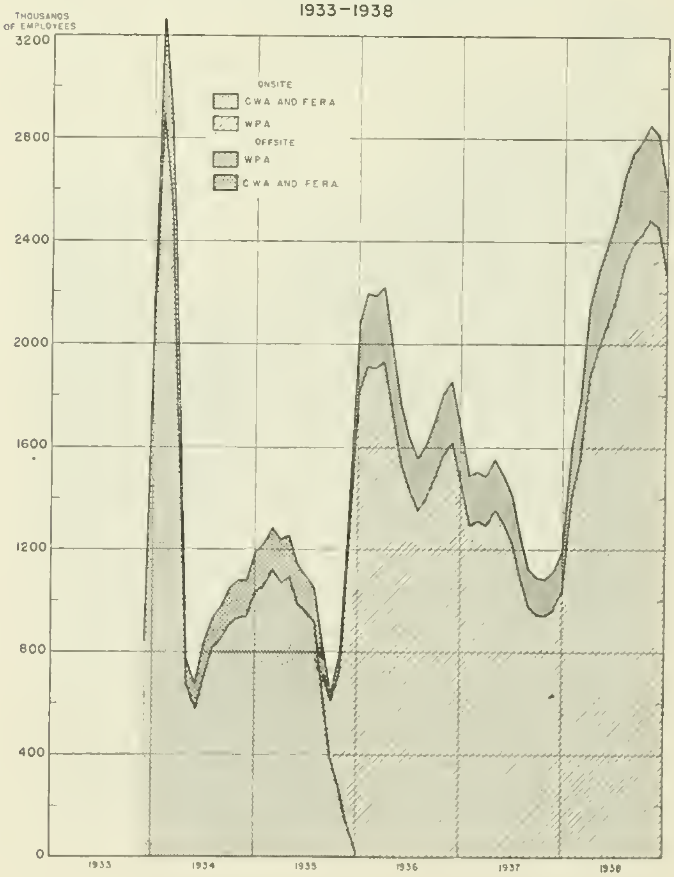
[1] FIGURES INCLUDE ALL EMPLOYMENT ON P W A NON-FEDERAL AND FEDERAL AID HIGHWAY PROJECTS.

SOURCE SEE TABLE 10

FIG 6

ESTIMATED ONSITE AND OFFSITE EMPLOYMENT ON WORK RELIEF CONSTRUCTION

1933–1938



SOURCE SEE TABLE 10

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[5] That this is only a comparison of relative magnitudes should be emphasized. Some Federal construction would have been undertaken under any circumstances during the depression. For this reason one cannot say that all public construction employment was a net deduction from unemployment.

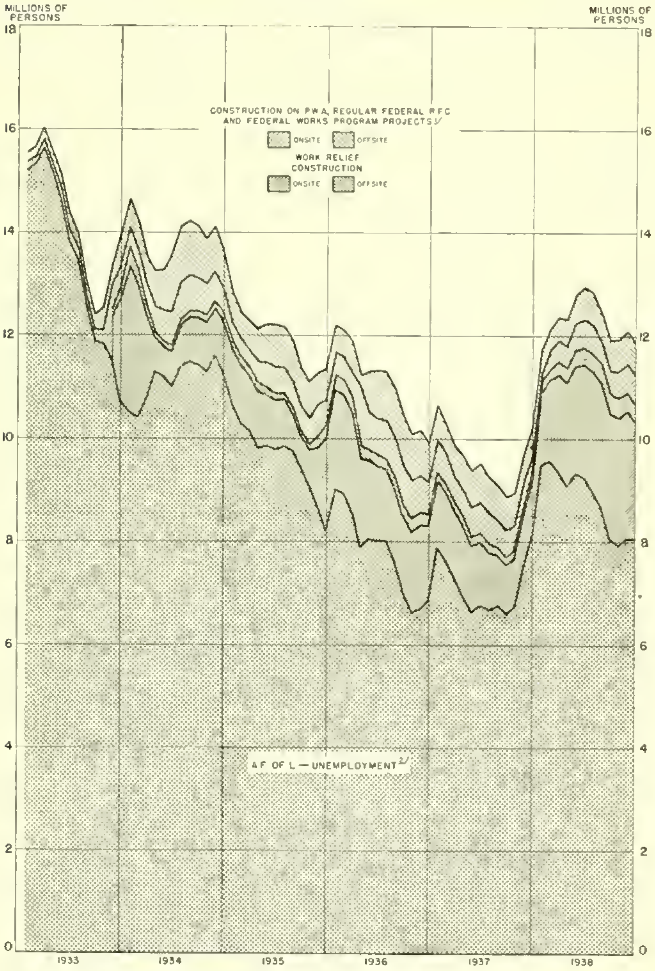
federally financed construction employment had it not been for the public works financed in part or in whole by the Federal Government and for relief construction. Figure 7 shows, by months, the American Federation of Labor unemployment estimates and the employment on construction from 1933–38.

It will be observed that the National Industrial Conference Board estimates are consistently and at times substantially below those of the American Federation of Labor. Using the Federation's estimates, it appears that, on the average during 1934–38, on-site employment on PWA projects, regular Federal construction, and Federal projects under the Works Program was roughly equivalent to 6 percent of the adjusted unemployment. The range was from a low of 4.7 percent in 1935 to a maximum of 8.4 percent in 1936. Combining on-site employment with estimated off-site employment, it appears that total primary employment was equivalent on the average from 1934–38 to 13.2 percent of unemployment, the range being from 10.7 percent in 1934 to 18.7 percent in 1936. On-site employment on work relief construction over the 5-year period was equivalent to almost 16 percent of unemployment, and combined on-site and estimated off-site to nearly 19 percent. The ranges were from 10.6 and 12.2 percent respectively, in 1935 to 24.0 and 27.8 percent in 1938.

FIG 7

ESTIMATED TOTAL UNEMPLOYMENT COMPARED WITH ESTIMATED ONSITE AND OFFSITE EMPLOYMENT ON CONSTRUCTION FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS

1933–1938



1/ EMPLOYMENT ON PWA AND REGULAR FEDERAL CONSTRUCTION INCLUDES ALL EMPLOYMENT ON PROJECTS FINANCED WHOLLY OR PARTIALLY FROM FEDERAL FUNDS

2/ EMPLOYMENT ON WORK RELIEF CONSTRUCTION HAS BEEN SUBTRACTED FROM TOTAL UNEMPLOYMENT ESTIMATES

SOURCE SEE TABLE 10

If the National Industrial Conference Board series is used, total on-site and estimated off-site employment on PWA, regular Federal construction, and Federal projects under the Works Program amounted to about 15 percent of unemployment during 1934–38. All employment provided by work relief construction amounted to about 21 percent, the range being from 13.4 percent in 1935 to 28.8 percent in 1938. The year 1933 has been excluded from the aggregate averages, since the PWA and work relief programs did not get under way until the end of the year.

It is evident from these figures that federally financed construction activities have been a reasonably significant factor in the employment situation in recent years. Over the 5-year period, 1934–38, approximately one man to each seven unemployed had work, on-site or

TABLE 11.—*Comparison of estimated total unemployment with on-site employment and with combined on-site and estimated off-site employment, on construction financed wholly or partially from PWA, regular Federal and ERA funds,*[1] *1933–38*

[In thousands of persons]

	1933	1934	1935	1936	1937	1938	Average, 1934–38
Unemployment:							
A. F. of L. estimates	13,723	12,364	10,652	9,394	8,282	10,936	10,326
NICB estimates	12,773	10,523	9,843	8,159	7,028	10,625	9,236
A. F. of L.[2]	13,477	11,150	9,627	7,784	7,138	8,821	8,904
NICB [2]	12,527	9,309	8,818	6,549	5,884	8,510	7,814
Employment on PWA, RFC, regular Federal projects and Federal projects under Works Program:							
On-site	229	534	456	656	538	491	535
Off-site	236	656	588	801	616	546	641
Total	465	1,190	1,044	1,457	1,154	1,037	1,176
As percent of adjusted unemployment—A. F. of L.:							
On-site	1.7	4.8	4.7	8.4	7.5	5.6	6.0
Off-site	1.8	5.9	6.1	10.3	8.6	6.2	7.2
Total	3.5	10.7	10.8	18.7	16.1	11.8	13.2
As percent of adjusted unemployment—NICB:							
On-site	1.8	5.7	5.2	10.0	9.1	5.8	6.8
Off-site	1.9	7.1	6.7	12.2	10.5	6.4	8.2
Total	3.7	12.8	11.9	22.2	19.6	12.2	15.0

[1] On-site and off-site figures are those presented in table 10, and include employment on PWA non-Federal projects and Federal-aid highways, for which part of the funds were supplied by States or localities. All PWA projects are included.

[2] Adjusted by subtracting employment on work relief construction.

Source: See table 10.

off-site, through regular Federal and PWA construction, and one to each five unemployed found employment on work relief construction. It is worth repeating once more, however, that the estimates of off-site employment developed in the previous section have been used, and it was concluded there that these estimates may approach more closely the "maximum possible" rather than the actual employment in furnishing materials for public construction. On the other hand, the on-site and off-site employment represent only the identifiable employment on Federal or federally assisted construction. Employment has been generated by the expenditure of the wages so received; if this could be identified it could properly be added to give the total employment effect of the public construction activities.

The Regional Distribution of On-site Federally Financed Public Works Employment

In chapter II mention has been made of the problem of adjusting public works employment to the regional or geographic distribution of unemployment. In relating public works employment to unemployment it is therefore of interest to compare the regional distribution of this employment with the volume of unemployment in different parts of the country. Again the data available offer difficulties. No data are available on the regional distribution of off-site employment. Moreover it is necessary to make rough estimates of the regional distribution of the unemployed since no such data are regularly available. For the present purposes, estimates of regional unemployment have been made by applying to the aggregate unemployment figures of the American Federation of Labor the regional distribution percentages of the National Unemployment Census of November 1937. Because it is entirely possible that shifts have occurred in the relative volume of unemployment by regions, there are possibly substantial errors in the regional distribution of aggregate unemployment for the years other than 1937. However, the range in the percentages of regional unemployment which federally financed construction employment represents is sufficiently large that it is unlikely that these errors are invalidating for the purpose at hand. It should be noted that the employment on work relief construction has not been subtracted from the aggregate unemployment figures as was the case in the previous section.

TABLE 12.—*Comparison of estimated total unemployment with estimated on-site employment, and with combined on-site and estimated off-site employment, on work relief construction 1933–38*

[In thousands of persons]

	1933	1934	1935	1936	1937	1938	Average 1934–38
Unemployment:							
A. F. of L. estimates	13, 723	12, 364	10, 652	9, 394	8, 282	10, 936	10, 326
NICB estimates	12, 773	10, 523	9, 843	8, 159	7, 028	10, 625	9, 236
A. F. of L. adjusted estimates [1]	13, 477	11, 150	9, 627	7, 784	7, 138	8, 821	8, 904
NICB adjusted estimates [1]	12, 527	9, 309	8, 818	6, 549	5, 884	8, 510	7, 814
Employment on work relief construction:							
On-site	246	1, 214	1, 025	1, 610	1, 144	2, 115	1, 422
Off-site	34	170	150	258	183	338	220
Total	280	1, 384	1, 175	1, 868	1, 327	2, 453	1, 642
As percent of adjusted unemployment (A. F. of L.):							
On-site	1. 8	10. 9	10. 6	20. 7	16. 0	24. 0	15. 9
Off-site	. 3	1. 5	1. 6	3. 3	2. 6	3. 8	2. 5
Total	2. 1	12. 4	12. 2	24. 0	18. 6	27. 8	18. 4
As percent of adjusted unemployment (NICB):							
On-site	2. 0	13. 0	11. 7	24. 6	19. 5	24. 8	18. 2
Off-site	. 3	1. 9	1. 7	3. 9	3. 1	4. 0	2. 8
Total	2. 3	14. 9	13. 4	28. 5	22. 6	28. 8	21. 0

[1] Adjusted by subtracting employment on work relief construction.

Source: See table 10.

In table 13 the regional distribution of on-site employment of PWA and regular Federal projects is presented for 1935–38. Table 14 shows this employment as a percent of unemployment by regions, and table 15 as a percent of population by regions. Referring to table 14, it will be observed that on-site employment on PWA and regular Federal construction, 1935–38, ranged from 2.5 percent of unemployment in the Middle Atlantic States to 7.5 percent in the Mountain States. The lowest percentage in any of the 4 years was 1.8 percent in the East North Central States in 1938, and the highest was 8.6 percent in the Mountain States in 1936. During the entire period the percentages were consistently far below average in the Middle Atlantic and East North Central States and far above average in the Mountain States. The East South Central, South Atlantic, and Pacific States also showed percentages substantially above the average.

Furthermore, it is apparent that the different classes of federally financed construction show substantial differences in the uniformity of the geographical distribution of their on-site employment. Table 16 shows the range in the variations from one region to another in the percentages of unemployment represented by the different categories of Federal construction. On the average for the 4-year period the highest regional percentage of PWA Federal projects was 6.8 times as great as the lowest regional percentage. Similarly, for regular Federal projects the highest regional percentage was 4.4 times the lowest. In contrast, the highest regional percentage of PWA non-Federal projects was only 1.6 times the lowest percentage. This means that it is the construction conducted by Federal departments which has caused the large differences in the shares of individual regions. The projects conducted by States and localities with the aid of Federal funds (the non-Federal PWA programs) have shown, on the average, a fair degree of regional uniformity in on-site employment in relation to unemployment.[6]

In view of the nature of the estimates of the regional distribution of unemployment which have been used, it is of interest to check the regional distribution of public works construction employment against total population. Table 15 gives the percentages of regional population which on-site employment on PWA and regular Federal construction were from 1935–38. It will be readily observed that the conclusions to be drawn with respect to geographical distribution are much the same with respect to unemployment. The Middle Atlantic and East North Central States were substantially below the average for the country. For the Mountain States and, to a lesser extent, for the Pacific and East South Central States, the ratio of public works employment to total population was substantially above the average. Again it is construction for the Federal Government itself which accounts for the variation. Table 17 shows the range in regional variations in public works on-site employment expressed as a percentage of population. On the average from 1935–38, the highest regional percentage of employment on regular Federal projects was 5.6 times the lowest regional percentage, and the highest on PWA Federal projects averaged 6.3 times the lowest. On the other hand, the highest regional percentage on PWA non-Federal projects is only 1.7 times the lowest.

The factors which determine the regional distribution of public works projects are numerous. In the case of Federal projects these appear, quite clearly, to be more restrictive than in the case of the non-Federal programs. As suggested in a previous chapter, the distribution of Federal construction is governed by the location of Federal activities; these are more concentrated in some areas than others. Reclamation, power development, and conservation activities are, in general, limited to certain geographical areas, most prominently the far Western States. With respect to non-Federal projects,

TABLE 13.—*On-site employment on PWA and regular Federal construction, by regions, 1935–38*

[In thousands of employees]

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
1935:									
PWA Federal	11.3	23.0	22.7	31.4	38.7	28.0	22.3	20.1	14.9
PWA non-Federal	12.1	27.0	19.9	17.7	17.5	5.8	11.5	4.5	15.2
Regular Federal	3.2	4.4	3.6	5.1	8.1	2.8	7.0	3.9	3.2
Total	26.6	54.4	46.2	54.2	64.3	36.6	40.8	28.5	33.3
1936:									
PWA Federal	5.0	12.9	7.6	7.3	18.4	8.2	6.8	10.3	5.9
PWA non-Federal	16.6	45.2	44.9	22.8	23.4	18.6	22.7	7.3	23.3
Regular Federal	11.5	17.4	12.6	11.9	17.9	10.8	12.8	10.6	8.9
Total	33.1	75.5	65.1	42.0	59.7	37.6	42.3	28.2	38.1
1937:									
PWA Federal	.5	6.2	3.8	2.5	7.7	.4	4.5	4.5	2.1
PWA non-Federal	7.0	32.5	30.1	15.1	14.1	20.9	12.2	6.2	14.7
Regular Federal	19.7	24.8	18.3	18.5	29.8	20.3	14.3	13.8	12.9
Total	27.2	63.5	52.2	36.1	51.6	41.6	31.0	24.5	29.7
1938:									
PWA Federal	.5	2.4	2.9	2.4	3.7	.7	3.0	2.3	2.9
PWA non-Federal	3.9	22.7	16.3	11.7	11.0	9.1	9.2	4.9	8.0
Regular Federal	20.2	30.2	19.4	19.0	36.1	26.6	19.2	13.9	21.5
Total	24.6	55.3	38.6	33.1	50.8	36.4	31.4	21.1	32.4
Average 1935–38:									
PWA Federal	4.3	11.1	9.2	10.9	17.1	9.3	9.2	9.3	6.5
PWA non-Federal	9.9	31.9	27.8	16.8	16.5	13.6	13.9	5.7	15.3
Regular Federal	13.7	19.2	13.5	13.6	23.0	15.1	13.3	10.6	11.6
Total	27.9	62.2	50.5	41.3	56.6	38.0	36.4	25.6	33.4

NOTE.—Employment figures are yearly averages of monthly maximums, taken from Bureau of Labor Statistics records. The figures for regular Federal construction cover only contracts awarded after July 1, 1934; and the 1935 totals are, for that reason, not as large as employment figures presented in previous sections. Employment on PWA non-Federal projects and Federal-aid highways is included; part of the funds for these projects was supplied by States and localities. Employment in railroad-car and locomotive shops is excluded entirely; employment on Federal low-cost housing projects is included in the PWA non-Federal figures.

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[6] The difference in the distribution of off-site employment between the two classes of construction will be smaller. The same localities, in some degree, will provide materials for both programs.

the ability of Federal authorities to distribute them geographically is limited by the need for relying on the initiative and cooperation of State and local governments. Past experience indicates, however, that the possibility of securing a reasonably uniform distribution in relation to unemployment and population is much greater in the case of federally aided non-Federal projects than in the case of federally conducted projects.

The "Employment Efficiencies" of Specific Programs and Project Types

Mention has been made previously of the existence of considerable variation in the employment provided by different classes of public works projects. This variation takes two forms: First, the same type of project conducted under different programs may involve varying amounts of total labor, both on-site and off-site, per dollar of cost; secondly, different types of construction conducted under the auspices of the same agency involve substantially different proportions of on-site and off-site labor, and also varying percentages of their total costs go for labor, materials, and other expenses, including profits. The size of the construction job also has an important bearing on the employment per dollar of expenditure, at least on the site of construction; material with respect to this aspect is presented in chapter VI.

The estimated total cost, total number of on-site and off-site man-hours, and the cost per man-hour for non-Federal PWA, Federal PWA, regular Federal, and WPA construction is shown in table 18. Break-downs have been made for building construction, street and road projects, and water and sewerage projects. It should be emphasized that both total cost and total man-hours are estimates, and the margin of error in each is substantial. However, the cost of providing a man-hour of employment appears to have differed materially. Thus for non-Federal PWA projects the cost per man-hour was $1.12, that for PWA Federal projects 88 cents, and that for regular Federal construction $1.03; whereas, for all WPA projects, the cost was only 55 cents. Except in the case of work relief construction, however, these differences are a result of differences in project composition between the pro-

TABLE 14.—*On-site employment on PWA and regular Federal construction expressed as percent of unemployment, by regions, 1935–38*

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
1935:										
PWA Federal	1.4	0.9	1.1	3.1	3.3	3.7	2.3	5.4	1.9	2.0
PWA non-Federal	1.5	1.0	1.0	1.7	1.5	.8	1.2	1.2	2.0	1.2
Regular Federal	.4	.2	.2	.5	.7	.4	.7	1.0	.4	.4
Total	3.3	2.0	2.2	5.3	5.5	4.8	4.2	7.6	4.3	3.6
1936:										
PWA Federal	.7	.5	.4	.8	1.8	1.2	.8	3.1	.9	.9
PWA non-Federal	2.3	1.9	2.5	2.5	2.3	2.8	2.7	2.2	3.4	2.4
Regular Federal	1.6	.7	.7	1.3	1.7	1.6	1.5	3.2	1.3	1.2
Total	4.6	3.2	3.6	4.7	5.8	5.6	4.9	8.6	5.6	4.5
1937:										
PWA Federal	.1	.3	.2	.3	.9	.1	.6	1.6	.3	.4
PWA non-Federal	1.1	1.5	1.9	1.9	1.6	3.6	1.6	2.1	2.4	1.8
Regular Federal	3.1	1.2	1.1	2.3	3.3	3.5	1.9	4.8	2.1	2.1
Total	4.3	3.0	3.2	4.5	5.7	7.1	4.1	8.5	4.9	4.3
1938:										
PWA Federal	.1	.1	.1	.2	.3	.1	.3	.6	.4	.2
PWA non-Federal	.5	.8	.8	1.1	.9	1.2	.9	1.3	1.0	.9
Regular Federal	2.4	1.1	.9	1.8	3.0	3.4	1.9	3.6	2.7	1.9
Total	3.0	2.0	1.8	3.2	4.3	4.7	3.2	5.5	4.1	3.0
Average 1935–38:										
PWA Federal	.6	.4	.5	1.2	1.6	1.3	1.0	2.7	.9	.9
PWA non-Federal	1.3	1.3	1.5	1.8	1.5	2.0	1.6	1.7	2.1	1.5
Regular Federal	1.8	.8	.7	1.4	2.1	2.2	1.5	3.1	1.6	1.4
Total	3.7	2.5	2.6	4.4	5.3	5.5	4.1	7.5	4.7	3.8

NOTE.—Unemployment figures are the American Federation of Labor estimates distributed by regions according to percentages derived from the National Unemployment Census of November 1937, in the following manner: Totally unemployed registered by regions and emergency workers registered by regions were divided by estimated regional percentages of completeness of registration to get total estimated wholly unemployed and emergency workers (partially unemployed being excluded); the regional figures were then divided by the national total to get regional percentages. See *Census of Partial Employment, Unemployment and Occupations: 1937; Final Report for Geographic Divisions*, table A, p. 1; and vol. IV, *Enumerative Check Census*, tables 54 and 55, pp. 118–119.

TABLE 15.—*On-site employment on PWA and regular Federal construction expressed as percent of population, by regions, 1935–38*

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Total
1935:										
PWA Federal	0.13	0.08	0.09	0.23	0.23	0.27	0.18	0.54	0.17	0.17
PWA non-Federal	.14	.10	.08	.13	.10	.06	.09	.12	.18	.10
Regular Federal	.04	.02	.01	.04	.05	.03	.06	.10	.04	.03
Total	.31	.20	.18	.40	.38	.35	.32	.76	.39	.30
1936:										
PWA Federal	.06	.05	.03	.05	.11	.08	.05	.27	.05	.06
PWA non-Federal	.19	.16	.17	.17	.14	.18	.18	.19	.27	.18
Regular Federal	.13	.06	.05	.09	.10	.10	.10	.28	.10	.09
Total	.39	.28	.25	.30	.35	.35	.33	.75	.44	.33
1937:										
PWA Federal	.01	.02	.01	.02	.04	(1)	.03	.12	.02	.02
PWA non-Federal	.08	.12	.12	.11	.08	.19	.09	.16	.17	.12
Regular Federal	.23	.09	.07	.13	.17	.19	.11	.36	.15	.13
Total	.32	.23	.20	.26	.30	.39	.24	.65	.34	.28
1938:										
PWA Federal	.01	.01	.01	.02	.02	.01	.02	.06	.03	.02
PWA non-Federal	.05	.08	.06	.08	.06	.08	.07	.13	.09	.07
Regular Federal	.23	.11	.07	.14	.21	.25	.15	.36	.24	.16
Total	.28	.20	.15	.24	.29	.34	.24	.55	.36	.25
Average 1935–38:										
PWA Federal	.05	.04	.04	.08	.10	.09	.07	.25	.07	.07
PWA non-Federal	.12	.12	.11	.12	.10	.13	.11	.15	.17	.12
Regular Federal	.16	.07	.05	.10	.13	.14	.10	.28	.13	10
Total	.33	.23	.20	.30	.33	.36	.28	.68	.38	.29

[1] Less than 0.005.

Source: Population figures are the *Bureau of Census Annual Estimates*, 1935–37: the 1938 figures were estimated by extrapolation.

TABLE 16.—*Range of regional variations in percentages of unemployment represented by on-site employment on regular Federal and PWA construction, 1935–38*

[Number of times highest regional percentage is of lowest]

Year	Regular Federal	PWA Federal	PWA non-Federal	Total
1935	5.0	6.0	2.5	3.8
1936	4.6	7.8	1.8	2.7
1937	4.4	16.0	3.3	2.8
1938	4.0	6.0	2.6	3.1
Total 1935–38	4.4	6.8	1.6	3.0

TABLE 17.—*Range of regional variations in percentages of population represented by on-site employment on regular Federal and PWA construction, 1935–38*

[Number of times highest regional percentage is of lowest]

Year	Regular Federal	PWA Federal	PWA non-Federal	Total
1935	10.1	6.8	3.0	4.2
1936	5.6	9.0	1.9	3.0
1937	5.1	(1)	2.4	3.2
1938	5.1	6.0	2.6	3.7
Total 1935–38	5.6	6.3	1.7	3.4

[1] Lowest percentage is almost zero.

grams. For the same types of construction, the man-hour costs of PWA Federal and non-Federal projects and regular Federal projects are practically identical; when differences appear, they probably result from the varying size and nature of the specific projects of the same general type. The man-hour cost of work relief construction is below that of ordinary construction both in the aggregate and in comparable types of projects.

The low cost per man-hour on WPA construction results primarily from the larger proportion of unskilled labor on WPA projects, even though it be assumed that all programs pay "prevailing" rates. Anticipating somewhat the discussion in chapter V, it is important to note that the average hourly earnings (on-site) on WPA up to the end of 1938 were 48 cents, as contrasted with 81 cents on PWA non-Federal projects, 76 cents on PWA Federal projects, and 68 cents on regular Federal projects for the same period. Moreover, as we have seen, over 85 percent of primary employment on WPA construction is on-site, and therefore subject to the low wage rate, whereas less than 40 percent of PWA non-Federal primary employment is on-site. Similarly, the somewhat lower man-hour cost of regular

Table 18.—*Estimated total costs, man-hours, and cost per man-hour for PWA, regular Federal and WPA construction*

	Estimated total costs (in millions of dollars)	Estimated total man-hours (on-site and off-site) (in millions of man-hours)	Cost per man-hour (in dollars)
All projects:			
PWA:			
Federal	[1] 1,693	1,919	0.88
Non-Federal	[1] 2,578	2,293	1.12
Regular Federal	[2] 1,862	1,814	1.03
WPA	[3] 6,239	11,271	.55
Building construction:			
PWA:			
Federal	[4] 317	319	.99
Non-Federal	[4] 1,071	1,073	1.00
Regular Federal	[5] 189	187	1.01
WPA	[6] 710	974	.73
Streets and roads:			
PWA:			
Federal	[4] 464	530	.88
Non-Federal	[4] 232	265	.88
Regular Federal	[5] 615	689	.89
WPA	[6] 2,277	4,385	.52
Water and sewerage:			
PWA:			
Federal	[4] 6	7	.86
Non-Federal	[4] 546	626	.87
WPA	[6] 629	1,050	.60

[1] Total reported project costs according to records of the Projects and Statistics Division of PWA.

[2] Total estimated from known aggregate of payrolls and material orders.

[3] Total costs and breakdowns estimated from known totals of material orders, payrolls, rentals and services.

[4] Projects and Statistics Division, PWA.

[5] Known aggregates of pay rolls and material orders were divided by the percentage which they represent of total expenditures, based on PWA studies of relative costs for various project types.

[6] WPA project type cost figures.

Note.—PWA and WPA estimates cover the entire programs. Regular Federal estimates cover only projects for which contracts were awarded after July 1, 1934, and include Federal-aid highways.

Federal projects arises from the lower on-site wages paid plus the slightly greater proportion of on-site labor to total labor.

In table 19 the man-hour costs of PWA, regular Federal, and WPA construction are adjusted for differences in on-site wage rates by assuming that all three types provided hourly earnings equivalent to those on PWA non-Federal projects (for that proportion of their primary employment which is on-site). Under this assumption the man-hour costs of PWA Federal, regular Federal, and WPA construction become 91 cents, $1.11, and 74 cents, respectively, as compared with $1.12 on PWA non-Federal construction. For a comparable type of construction, buildings, the PWA Federal, non-Federal, and regular Federal costs are quite similar. Furthermore, the WPA man-hour cost for buildings is within 10 percent of the PWA cost: 90 cents compared to 98 cents and $1. Consequently, even when one considers the margin of error involved in the off-site estimates, it seems fair to conclude that the differences in the man-hour costs of the various programs of construction arise primarily from variations in on-site hourly earnings. And these variations in earnings result largely from the differing proportions of skilled and unskilled labor employed.

With respect to different kinds of construction within the same program, the Bureau of Labor Statistics has made detailed studies of the total volume of employment provided by different project types per dollar of cost. Table 20 shows the on-site and off-site man-hours per million dollars of construction for nine project types, as compiled by the Bureau of Labor Statistics. The total number of man-hours provided per million dollars of cost varies from 781,000 in the case of steam power and light projects to 1,144,000 for streets and roads. In terms of the cost per man-hour of employment provided, the range is from $1.28 for steam power and light projects to $0.87 for streets and roads.

When the primary purpose of public construction is to provide employment, the employment efficiency of different types of projects as presented above may well serve as a partial guide in formulating the specific program most effectively serving that end. For

Table 19.—*Estimated man-hour costs on PWA, regular Federal, and WPA construction adjusted to exclude differences in on-site wage rates*

	All construction				Building construction			
	PWA non-Federal	PWA Federal	Regular Federal	WPA	PWA non-Federal	PWA Federal	Regular Federal	WPA
Average cost per man-hour	1.12	0.88	1.03	0.55	1.00	0.99	1.01	0.73
Percent below PWA non-Federal man-hour cost		21.4	8.0	51.0		1.0	[4] 1.0	27.0
Average hourly on-site wage rate [1]	.81	.76	.68	.48	.88	.91	.83	.63
Percent below PWA non-Federal wage rate		6.2	16.0	40.7		[3] 3.4	5.7	28.4
Cost per man-hour adjusted to PWA non-Federal on-site wage rates [2]		.91	1.11	.74		.98	1.03	.90

[1] During the period from September 1935 through December 1938.

[2] These rates were arrived at by increasing by 16 percent in the case of regular Federal, 40.7 percent in the case of WPA construction, and 6.2 percent on PWA Federal construction, that portion of the man-hour cost attributable to on-site employment. The percentages which on-site employment represented of total employment were 49 percent for regular Federal, 86 percent for WPA construction, and 50 percent for PWA Federal construction.

[3] Percent above PWA non-Federal wage rate.

[4] Percent above PWA non-Federal average cost per man-hour.

Source: Average hourly on-site wage for PWA is calculated from Bureau of Labor Statistics revised records. Regular Federal and WPA figures are from *Employment and Payrolls*, Bureau of Labor Statistics, September 1935 to December 1938. For other data see tables 9 and 18, ch. IV.

Table 20.—*On-site and off-site man-hours per $1,000,000 of PWA construction contracts awarded, by types of projects*

[In thousands of man-hours]

Type of project	On-site	Off-site	Total man-hours	Ratio: off-site to on-site	Cost per man-hour
Nonresidential building	344	657	1,001	1.91	$1.00
Residential building	410	615	1,025	1.50	.98
Water supply	262	876	1,138	3.34	.88
Sewage disposal	358	667	1,025	1.86	.98
Streets and roads	475	669	1,144	1.41	.87
Reclamation	402	645	1,047	1.60	.95
Steam power and light	161	620	781	3.85	1.28
Diesel power and light	161	641	802	3.98	1.25
Naval vessels	491	589	1,080	1.20	.93

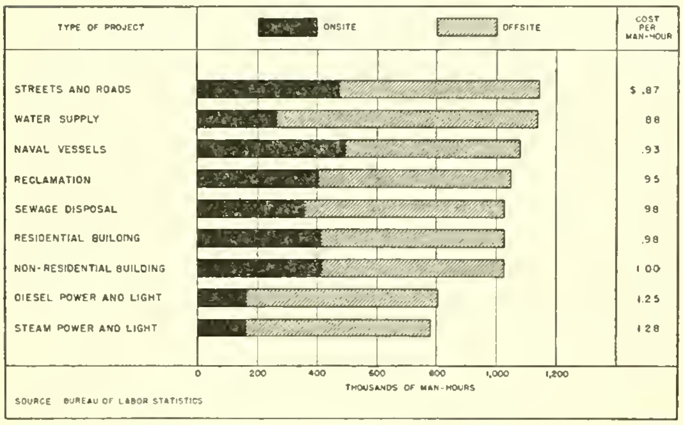
Source: Bureau of Labor Statistics.

example, for maximum employment regardless of skills, construction of streets and roads and water-supply projects would be emphasized. To increase employment of skilled labor, light, power, and building projects would be favored. As indicated in chapter VI, total on-site employment is increased by favoring small projects in each class over large ones. However, even when the objective of a public construction program is the alleviation of unemployment, there are, as suggested in chapter II, several other things which bear upon the selection of the projects. The variation in employment efficiency between project types is only about 5 or 10 percent for the most part, and it disregards differences in skills employed. When the secondary or unidentifiable effects of public construction are also considered, these differences in employment efficiency become of still less significance. Considerations of usefulness or community value, effect on private investment, and the type of labor needing employment are almost certain to outweigh in importance the question of employment efficiency.

Finally, it should be emphasized that employment efficiency, as it has been defined in this study, means solely the number of on-site and off-site man-hours provided per dollar of cost. There is, however, another aspect of the relative efficiency of employment, namely, the efficiency with which the construction work is done, the amount of product per dollar of cost provided by, for example, PWA in contrast with WPA. An investigation into this subject has not been possible within the limitations of the present study, but nevertheless it constitutes properly a primary criterion in evaluating the merits and functions of the several types of construction programs.

FIG 8

ESTIMATED ONSITE AND OFFSITE MAN-HOURS PER $1,000,000 OF PWA CONSTRUCTION CONTRACTS AWARDED, BY TYPES OF PROJECTS



SOURCE BUREAU OF LABOR STATISTICS

Summary

The question of the relationship of public works construction to the level of employment is one of peculiar interest, because the persistent and large volume of unemployment has been the most disturbing problem of the economic system since 1930. Public construction has been the most prominent instrument by means of which governmental action has attempted to alleviate that problem. On the basis of 6 years of experience, we may well inquire into the degree of success which has attended past efforts along this line.

It has been shown that total on-site employment on new construction, excluding work relief, declined from an average of 2,265,000 men in the years 1925–29 to 861,000 in 1933, and in the period 1934–38 averaged 1,317,000, or only 58 percent of the predepression level. Even in the peak year 1937, employment was only 1,575,000, or 69.5 percent of predepression employment. This decline, however, was due to the drop in private construction employment. The total of public works employment increased from 485,000 in 1925–29 to 648,000 in 1934–38. In the latter period it represented 49 percent of total construction employment compared with 21 percent before the depression. Furthermore, the increased level of public construction employment has been entirely due to the sixfold rise in Federal construction employment and to the sixfold rise in employment on construction financed jointly by the Federal Government and by States or localities. Employment on State and local public works, excluding non-Federal PWA and Federal-aid highway projects, has at no time since 1933 reached more than 53 percent of its 1925–29 average, or even 75 percent of the 1933 volume. Federal public works employment, however, rose from 40,000 in 1925–29 to 243,000 in 1934–38, and construction financed jointly by the Federal Government and by States or localities increased from 37,000 to 227,000. These two groups together provided in 1934–38 around 73 percent of public construction and 36 percent of all construction employment, in contrast to 16 percent and 3.4 percent in 1925–29.

In addition to engaging in usual types of construction, financed by PWA funds, regular appropriations, and the allocation of ERAA funds to Federal departments, the Federal Government has also maintained a very large volume of work relief construction. The primary purpose of this has been to provide jobs, and, if employment on such construction is included, the average of Federal and federally-aided on-site construction employment in 1934–38 is increased over 1925–29 by nearly 26 times. In these years employment on work relief construction averaged 1,422,000. This raised the Federal employment average to 1,665,000 and total construction employment to 2,739,000, which latter was 21 percent in excess of the 1925–29 level. Consequently, by means of extensive work relief construction the Federal Government has been able to provide a volume of on-site employment sufficiently large to compensate for the decline in State, local, and private on-site construction employment. This was not true, of course with respect to the accompanying volume of off-site employment.

The amount of on-site employment provided by Federal construction is not, however, the whole story. Employment is created in the factories supplying the required materials and equipment and in the administrative offices. This off-site employment is primarily related to the volume and nature of material orders. On the basis of studies made by the Bureau of Labor Statistics, it has been roughly estimated that, on the average in the years 1933–38, for every man-hour worked at the site, non-Federal PWA programs required 2 off-site man-hours, Federal PWA programs 1 off-site man-hour, regular Federal projects 1 off-site man-hour, WPA construction 0.16 off-site man-hour, Federal projects under the Works Program 0.6 off-site man-hour, CWA projects 0.12 off-site man-hour, and FERA projects 0.16 off-site man-hour. Using these ratios, it is estimated that the total off-site and on-site employment resulting from PWA, Federal projects under the Works Program, RFC, and regular Federal construction averaged 1,177,000 men from 1934–38, and the employment resulting from all work relief construction averaged 1,642,000 men. These figures, unlike the previous ones, include all employment on PWA and Federal-aid highway projects, although these were partly financed from State and local funds.

It has been emphasized, however, that extreme caution should be exercised in the use of these off-site ratios. They apply only to the period 1933–38, and to the past project compositions of the specific programs. The over-all program ratios vary substantially from time to time as the project composition of the individual programs change. Furthermore, not only are they estimates with substantial margins of error, but they have been calculated on a cost-accounting basis, without taking into consideration such factors as the changing productivity per factory worker, possible withdrawals from inventories, and (in the case of employment figures, as distinct from man-hours) the existing volume of part-time employment. It has been suggested, therefore, that the off-site estimates should be regarded as more nearly the maximum, rather than the actual, effects.

Breaking down the unemployment and public works employment figures into regional estimates, substantial variations have been found in the relationships of public works employment to unemployment in the different regions. This was likewise found to be true in a comparison of population and public works employment. In general, the percentages in the Mountain States were far above average and those in the Middle Atlantic and East North Central States below average. Furthermore, there were large differences between the regular Federal and PWA Federal projects and the PWA non-Federal projects in the degree of regional uniformity. The former showed a heavy concentration in certain areas, most notably the Mountain States, whereas the PWA non-Federal projects were distributed with a fair degree of evenness.

Within the aggregate of Federal construction, the different programs have involved varying costs per man-hour. A rough estimate indicates that the average over-all cost per man-hour, including both on-site and off-site employment, is $1.12 for PWA non-Federal programs, 88 cents for PWA Federal programs, 1.03 cents for regular Federal projects, and 55 cents for WPA projects. This difference, however, was found to arise, in the case of the different types of ordinary construction, from variations in project composition; and between ordinary and work relief construction, from the substantially lower on-site hourly earnings according in part with the larger use of unskilled labor on the latter.

Within the identical program, different types of projects show varying employment efficiencies. For example, studies of PWA construction by the Bureau of Labor Statistics indicate that street and road projects result in 1,144,000 man-hours (on-site and off-site) per million dollars of contracts awarded, whereas, at the other extreme, steam power and light projects involve only 781,000 man-hours. To the extent that a public works program is primarily aimed at providing employment, this range may be of some limited significance in selecting projects. The significance is limited because, not only must considerations of usefulness enter into the selection of projects, but projects which provide less total employment provide more skilled employment per dollar of expenditure.

Two general observations may be made on the basis of the material presented in this chapter. First, average on-site and off-site employment on Federal or federally aided public works has exceeded a million men annually in recent years. This must be counted a substantial contribution to total employment, and, when work relief employment on construction is added in, the combined total is impressive. Nonetheless, the unemployment problem in the United States is even larger, and if it continues at its recent magnitude, public construction activity, on the scale of the last 6 years, will fall short of providing a complete solution.

The second observation is that, within the construction and construction supply industries, public works can do, and have done, much to maintain the level of employment. If the objective of public works policy were the stabilization or partial stabilization of the notably unstable construction industry, then it could claim to have been a fair success in recent years, even if employment on work relief construction is not included. Substantial progress has been made toward maintaining the level of on-site employment against the decline in private and State and local (unaided) construction employment. It is possible that the public works achievement is more properly appraised in terms of its approach to this more modest objective.

CHAPTER V—RELATION OF FEDERALLY FINANCED CONSTRUCTION TO CONSTRUCTION COSTS AND PRICES

Up to this point we have been considering the general effects of Federal construction expenditure on employment and income, and on the output of the construction supply industries. It is important to examine the question whether or not Federal activity has affected construction costs and prices. Since all construction does draw from the same labor and material markets, the effect of a rise in public construction on construction costs would have repercussions on private construction. In this chapter the relationship between federally financed construction activity and construction costs in general and, more particularly, labor and material costs, is analyzed for the period from 1933 to 1938.

There are many factors which enter into price movements and it is always difficult to isolate and evaluate any of them. Consequently, it will be necessary to confine this analysis largely to a comparison of the cost-price movements in the construction industry, on the one hand, and federally financed expenditures, material orders, and wage rates, on the other hand. In some few cases it is possible to infer that Federal activity caused certain cost-price movements; for the most part it is not possible to do more than set out the relationships which have held in this field in recent years.

Where an expanded or emergency public works program is expected to stimulate private business activity, the relationship of the program to prices and costs is obviously of fundamental importance. If an increase in public construction is to have a full favorable effect on business, it is important that the favorable effect be shared by private construction, which has been the most distressed of major industries in recent times. If it appears that an increased public works program tends to increase construction costs, or even to bolster them at an inflated level, then its business creating value may be substantially diminished. Furthermore, the relationship of public works activity to construction costs is important from the standpoint of what the Government gets for its money.

There can be little doubt that public works construction and work relief both acted to sustain prices and wages in the building trades from 1933 onward. There is no means of estimating what effect on the wage structure would have resulted from continued competition from workers facing starvation. We can only say with certainty that it would have prevented wage increases and would probably have led to still further wage decreases. Material costs would not necessarily have been subjected to equally strong pressure, for in many lines at least it appears that idle capital resources did not lead to the type of violent price-cutting that would result from free competition among business enterprises struggling for a small amount of business.

In all probability an increasing volume of public construction must always have some steadying effect on construction prices and costs. It is no criticism of a federally financed public works program to say that its effect on these costs is equivalent to that of a similar volume of private activity. There would be cause for criticism, however, if substantial evidence could be discovered that an increase in such public works activity has a stronger tendency to increase or maintain costs than has an equivalent increase in the volume of private activity. There is some possibility that this may have been the case in the period under discussion.

Movements in Construction Costs and Volume

The attempt to present a statistical series of construction costs is made difficult by the absence of any index based on adequate information from year to year. In this connection, the difference between a price index and a cost index should be noted.[1] An index of construction prices combines the prices of the factors entering into construction, one period being selected as the base. A construction cost index represents the actual contract cost of similar projects, i. e., similar completed structures at various periods of time, also relative to the selected base. Consequently, the latter takes into account, not only the prices of the constituent elements, but also possible variations in the required quantities of those elements. This means that such factors as technological change and alterations in profit margins are considered.[2]

This distinction between price and cost indexes is of primary importance in the construction industry. Table 1 and figure 1 present three indexes of construction prices or costs from 1925 to 1938, 1926 being taken as the base year. The first of these indexes, that of the *Engineering News-Record*, is primarily a

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[1] See L. J. Chawner, "Construction Cost Indexes as Influenced by Technological Change and Other Factors," *Journal of the American Statistical Association*, September 1935, pp. 561-576.

[2] Over longer periods of time it is also necessary to take into account changes in specifications to take advantage of improved or cheapened materials with which one can build as much as or better than with the former specifications.

Table 1.—*Indexes of construction costs and volume, 1925–38*

[1926=100]

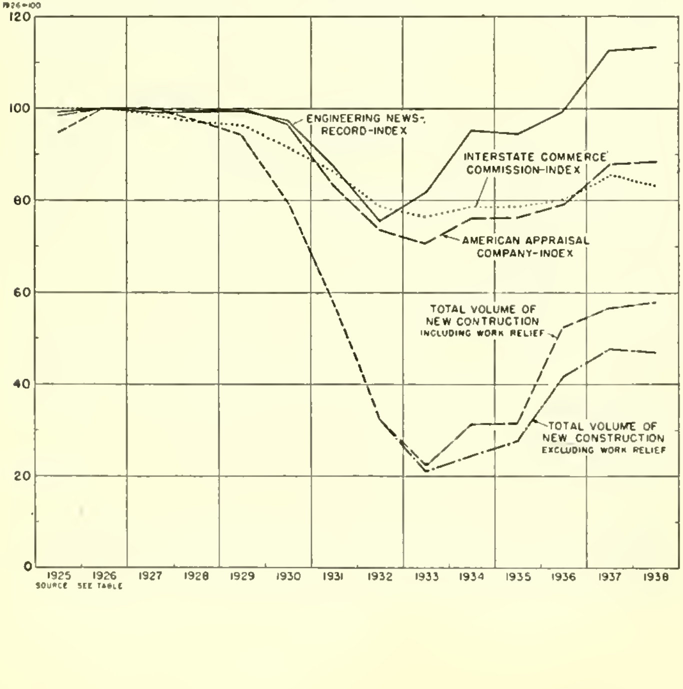
Year	Construction costs			Total volume of new construction [1]	
	Engineering News-Record index	American Appraisal Co. index	Interstate Commerce Commission index	Excluding work relief	Including work relief
1925	99.4	98.5	100.0	94.8	94.8
1926	100.0	100.0	100.0	100.0	100.0
1927	99.1	100.0	98.8	100.2	100.2
1928	99.4	99.5	97.0	97.4	97.4
1929	99.5	100.0	96.4	94.2	94.2
1930	97.5	96.6	91.6	79.8	79.8
1931	87.2	83.0	86.1	57.6	57.6
1932	75.5	73.8	78.9	32.6	32.6
1933	81.8	70.9	76.5	21.1	22.4
1934	95.2	76.2	78.9	24.7	31.2
1935	94.4	76.2	78.9	27.6	31.6
1936	99.2	79.1	80.1	41.6	52.8
1937	112.8	87.9	85.5	47.8	56.9
1938	113.4	88.3	83.1	47.0	58.0

[1] Based on estimates made by Department of Commerce.

price index and therefore represents the movements in the prices of certain selected building materials and labor, rather than the cost of constructing a standard project from year to year. On the other hand, the index of the Interstate Commerce Commission is compiled on the basis of contract figures representing the actual costs of various types of railroad construction and includes such factors as changes in technology and in profit margins. Consequently, it can be considered a more accurate indicator of the movements in the cost of constructing any standard project over a period of years. The index of the American Appraisal Co. can likewise be considered a cost rather than a price index since the quantities used in computing the index are determined from cost studies of actual construction work and thus estimate labor efficiency and technological change.

FIG. 1

INDEXES OF CONSTRUCTION COSTS AND VOLUME
1926–1938



It will be noted from figure 1 that all three indexes (1926 being the base year) declined from around 96 to 100 in 1929, to from 74 to 79 in 1932. This was accompanied by a much larger drop in the index of total construction volume, from 95 to 33. Beginning with 1932, however, the *Engineering News-Record* index rose sharply, with the exception of a small decline in 1935, to 113 in 1937 and 1938. The other two indexes showed no such substantial rise. They declined further in 1933, and by 1937 had recovered to only 86 in the case of the Interstate Commerce Commission index and 88 in the case of the American Appraisal Co. index. The volume of construction in these years, including work relief, although it increased substantially, had by 1938 recovered only 58 percent of its 1926 level.

On the basis of figure 1 it would appear that a substantial gap has developed since 1932 between the prices of construction materials and labor as represented by the *Engineering News-Record* index, and the actual cost of construction as represented by the Interstate Commerce Commission and American Appraisal Co. indexes. Labor and materials in 1938 were some 13 percent above the 1926 level while costs, as a whole, were still about an equivalent amount below. However, much of this gap is probably the result of the weight given the labor factor in the *Engineering News-Record* index, around 54 percent, as against 46 percent for materials. Since in recent years, as will be subsequently shown, wages have risen to unprecedentedly high levels, an index heavily weighted with wage rates will naturally show a disproportionate rise. Nevertheless, it is not likely that this element of weighting accounts for all of the gap, and it may be inferred that technological developments in construction techniques have had some part in causing the increasing margin between construction costs and prices. It must also be remembered that the influence of changing overhead and profit margins on costs is not reflected in the *Engineering News-Record* at all.

Table 2 and figure 2 present the quarterly movements in the volumes of Federal, State and local, and private expenditures for construction, compared with the quarterly movements of the *Engineering News-Record* and American Appraisal Co. indexes of construction costs. The quarterly distribution of PWA project costs was estimated from the quarterly volume of material orders and pay rolls, that of Federal construction from the quarterly volume of material orders. The quarterly figures for private and State and local construction were estimated on the basis of the Dodge series of contract awards in 37 States (with allowances for lags in the actual activity). The annual volumes

TABLE 2.—*Movements in construction costs and combined wholesale prices compared with estimated quarterly volumes of Federal, State and local, and private construction expenditures, 1933–38*[1]

Year and quarter	Construction costs (Engineering News-Record)	Construction costs (American Appraisal Co.)	Wholesale prices combined (BLS—all commodities)	Federal construction expenditures	Private construction expenditures	State and local construction expenditures	PWA project costs[2]
	1935=100			Millions of dollars			
1933:							
First	80.8	89.5	75.4	(3)	232	223	--------
Second	82.8	88.9	78.4	(3)	233	179	--------
Third	86.2	95.2	87.1	(3)	294	152	8
Fourth	96.7	96.5	88.7	(3)	332	153	105
1934:							
First	98.4	97.8	91.5	269	286	164	143
Second	101.0	99.7	92.4	399	286	201	311
Third	101.6	99.7	95.4	356	321	214	377
Fourth	102.5	100.3	95.7	356	339	215	282
1935:							
First	99.7	100.3	99.0	225	410	176	185
Second	99.3	100.3	100.0	273	364	155	228
Third	100.5	99.7	100.2	344	400	133	210
Fourth	100.5	99.7	100.9	392	431	152	183
1936:							
First	102.5	100.3	100.4	427	507	179	173
Second	103.9	102.2	99.0	585	597	254	281
Third	105.6	103.5	101.5	683	685	241	283
Fourth	106.7	106.7	103.4	640	762	207	229
1937:							
First	113.4	110.5	108.4	469	700	224	152
Second	119.2	115.5	109.4	522	784	198	180
Third	122.6	117.5	109.5	566	928	192	157
Fourth	123.0	116.8	104.4	486	914	231	118
1938:							
First	121.7	116.2	100.1	439	1,074	249	100
Second	120.8	115.5	98.0	541	741	236	134
Third	118.4	114.9	98.0	560	656	268	124
Fourth	119.4	115.5	96.7	599	636	336	204

of construction are those estimated by the Department of Commerce, except work relief construction for which WPA estimates were used. The category of Federal expenditures includes grants but excludes loans. It should be emphasized that the quarterly distribution can be considered at the most as only roughly indicative of the actual distribution of the annual estimates within the year.

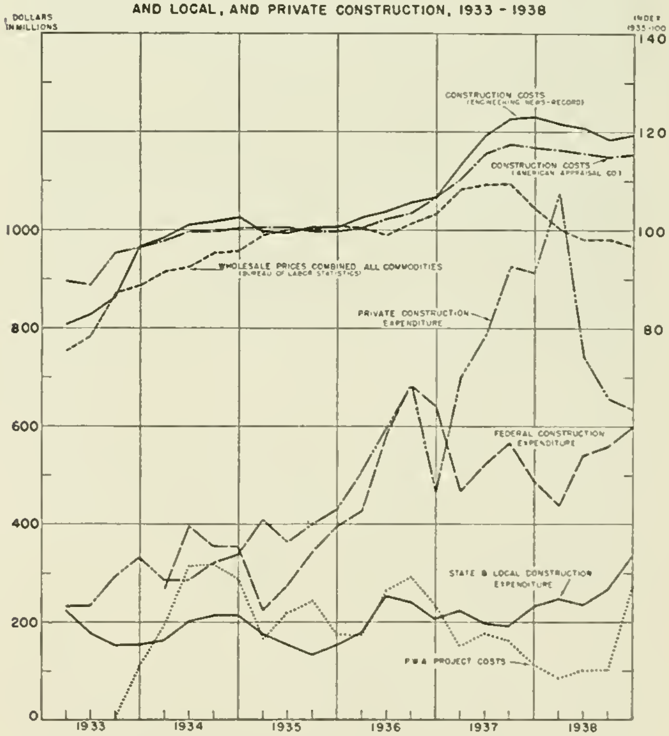
It will be observed that construction costs showed a very substantial increase in the last three quarters of 1933 and early 1934. This increase paralleled, although it anticipated somewhat, the rapid rise of PWA construction to its peak in the middle of 1934. On the other hand, the annual volume of private expenditures showed a substantial decrease in 1933 under 1932 and only an insignificant increase in 1934 over 1933. This increase in construction costs paralleled and was undoubtedly affected by the equivalent rise in wholesale prices generally, which occurred in this period as a result of the NRA and the recovery program. Insofar as it was influenced by the current volume of construction expenditures, the influence must be attributed primarily to the emergency public works program. And no doubt the expectations which were stimulated by the publicity and scope of the public works program, and shortly thereafter fulfilled in part by the flood of invitations to bid on public contracts, did put an upward pressure on costs.

In 1935 construction costs levelled off and even declined somewhat. This was accompanied by a decline of PWA construction from the 1934 peak, and regular Federal construction continued at a low level relative to subsequent years. The volume of private construction, on the other hand, increased substantially in this period. Again it should be noted that the movements in construction costs ran parallel with similar movements in wholesale prices generally.

Federal construction expenditure also showed a special relationship to movements in construction costs

FIG 2

MOVEMENTS IN CONSTRUCTION COSTS AND COMBINED WHOLESALE PRICES COMPARED WITH ESTIMATED QUARTERLY VOLUMES OF FEDERAL, STATE AND LOCAL, AND PRIVATE CONSTRUCTION, 1933 - 1938



SOURCE SEE FOOTNOTE 1, TABLE 2

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[1] Federal expenditure figures include PWA grants and Federal aid for highway grants but exclude loans and were distributed quarterly in accordance with the known volumes of quarterly material orders on projects financed wholly or partially from Federal funds. They also include work-relief construction. Figures for private construction were distributed quarterly in the following manner: The Dodge monthly series of private contracts awarded in 37 States was adjusted to an estimated lag in the actual construction activity (each month's contracts were distributed over that and the following 12 months in a ratio of 1-2-2-2-2-2-2-2-2-2-2-2-1, for commercial, farm, and public utility construction; and over that month and the following 8 months in a ratio of 1-2-2-2-2-2-2-2-1, for factory and residential construction); this distribution, converted into quarterly percentages, was then applied to the annual estimates of the Department of Commerce. The quarterly distribution of State and local construction was arrived at by using the distribution of the Dodge series of public contracts awarded (less Federal contracts) adjusted to a 4½-month lag in actual construction activity.

[2] Overlaps both Federal and State and local categories owing to the jointly financed, non-Federal projects.

[3] Not available.

Sources: For annual volumes, see tables 1 and 2, ch. III.

in the last 9 months of 1936. In this period construction costs broke away from the trend of wholesale prices in general and began a more rapid and sustained rise. In this period also, Federal construction expenditure was double the volume of any previous similar period, and PWA construction reached its secondary peak. It is possible that this abrupt rise in Federal construction expenditure was the initiating factor in the ensuing extraordinary increase in costs. However, at the same time, construction expenditure other than by the Federal Government was also showing a sustained rise. Undoubtedly the full stimulus to costs in 1936 and 1937 resulted from a complex of psychological and material factors, among which the peak in Federal construction expenditure may have been important only at the beginning. The real bulge of prices occurred during 1937, when, relative to 1936, it was private, not public, construction which was expanding.

Furthermore, in 1938 the relatively high level of Federal public works activity may have had some influence in preventing a decline, such as that in wholesale prices generally, from the high 1937 level of construction costs. It will be noted that construction costs fell only slightly in 1938 from the 1937 peak, whereas the combined wholesale price index of all commodities dropped from 109.5 to 96.7 (1935=100). This was true despite the fact that the previous rise in construction costs had been considerably larger than that in wholesale prices. In fact, the slight downward trend of construction costs in 1938 was clearly reversed in the last quarter of that year, although combined wholesale prices continued to fall off and private construction activity also showed its usual seasonal decline. PWA and Federal construction expenditure, on the other hand, increased substantially, largely as a result of the 1938 public works program. The relative strength of construction costs during 1938 and the upward turn at the end of the year may again have been related to the material and psychological effects of this new program.

It should be noted that during the entire period from 1933 to 1937, construction costs, as represented by the Interstate Commerce Commission and American Appraisal Co. indexes, were not out of line with wholesale prices generally, relative to 1926. It was not until 1938 that construction costs broke away to a significant degree from the level of all wholesale prices. On the other hand, the prices of factors entering into construction costs, as represented by the *Engineering News-Record* index, were substantially above the level of all wholesale prices (relative to 1926), particularly after 1934.

It has been observed in figure 1 that construction prices, as indicated by the *Engineering News-Record* index, have increased some 50 percent since 1932, and in 1937–38 reached a higher level than that of the predepression period. It may be of interest to compare the

TABLE 3.—*Indexes of construction costs, wage rates, and combined building material wholesale prices, 1925–38*

[1926=100]

Year and quarter	Construction costs (ENR)	Wholesale price combined building materials (BLS)	Construction wage rates common labor (ENR)	Construction wage rates skilled labor (ENR)
1925:				
First	101.0	104.1	99.5	94.5
Second	99.5	100.7	98.2	95.3
Third	98.0	100.3	96.7	96.1
Fourth	98.9	101.6	98.5	96.1
1926:				
First	99.6	100.9	98.7	96.9
Second	99.2	99.4	100.0	98.4
Third	100.0	99.8	101.1	100.0
Fourth	101.2	100.1	100.9	100.8
1927:				
First	101.0	97.3	102.0	102.3
Second	99.5	96.0	102.2	102.3
Third	98.2	94.2	101.3	104.7
Fourth	97.8	92.2	99.8	103.9
1928:				
First	98.2	92.1	100.2	104.7
Second	99.3	93.6	100.7	105.5
Third	99.5	94.8	102.2	105.5
Fourth	100.5	95.6	102.9	105.5
1929:				
First	100.6	95.7	101.8	105.5
Second	98.4	95.7	97.1	105.5
Third	99.1	95.4	98.2	106.3
Fourth	100.0	94.9	101.8	107.0
1930:				
First	99.7	94.1	102.6	107.8
Second	98.8	91.9	102.9	107.8
Third	96.4	87.8	102.4	108.6
Fourth	95.2	85.5	101.5	108.6
1931:				
First	93.8	82.9	98.4	107.0
Second	91.0	80.3	98.2	105.5
Third	82.9	77.6	85.2	93.8
Fourth	80.9	76.0	83.2	90.6
1932:				
First	77.1	73.8	80.8	87.7
Second	73.4	71.6	75.2	75.5
Third	75.0	69.9	77.0	77.3
Fourth	76.2	70.7	78.1	76.3
1933:				
First	76.3	70.1	78.1	78.0
Second	78.2	72.1	80.1	78.0
Third	81.4	81.2	81.4	78.7
Fourth	91.3	84.8	93.4	81.9
1934:				
First	92.9	86.4	95.4	83.5
Second	95.4	87.3	97.4	85.8
Third	96.0	86.1	97.1	87.4
Fourth	96.8	85.1	98.4	88.2
1935:				
First	94.2	84.9	96.5	87.4
Second	93.8	84.9	95.8	85.0
Third	94.9	85.5	96.5	85.0
Fourth	94.9	85.8	96.4	86.6
1936:				
First	96.8	85.5	99.8	88.2
Second	98.1	85.8	101.8	89.8
Third	99.7	86.9	103.5	91.3
Fourth	102.4	88.2	106.6	92.9
1937:				
First	107.1	93.5	110.6	97.6
Second	112.5	96.9	114.6	102.4
Third	115.7	96.4	121.9	107.1
Fourth	116.1	93.9	123.5	108.7
1938:				
First	115.0	91.5	123.5	109.4
Second	114.0	90.4	123.4	110.2
Third	111.8	89.4	123.5	112.6
Fourth	112.7	89.5	124.5	112.6

Source: Construction costs and wage rates are those compiled by the *Engineering News-Record*, the wage rates being converted into an index. The index of building material prices is that of the Bureau of Labor Statistics.

movements in the general index with the movements in the wholesale prices of combined building materials, and in the wage rates for common and skilled labor on construction projects. This is done in table 3 and figure 3. The index of combined building material prices is that compiled by the Bureau of Labor Statistics, and the indexes of wage rates have been determined from the average rates reported by the *Engineering News-Record.*

It will be observed from figure 3 that, since the base year of 1926, the indexes of wage rates have been consistently and at times substantially above that for building material prices, although the latter have themselves been above wholesale prices generally. In particular, since 1935 the rise in wage rates has substantially exceeded that of material prices; and in 1938, although material prices declined, wage rates showed a further increase. Moreover, the increase in the wage rates for common labor has been substantially greater relative to the 1926 base than that in the rates for skilled labor. In 1938 the index for common labor stood at 124, whereas that for skilled labor was 111, and that for building materials was 90. Consequently, it may be inferred that the large rise in the *Engineering News-Record* index of construction prices, which is heavily weighted with the labor factor, has been due in part to the rise in wage rates, and particularly in the rates for common labor.[3] However, the fact that the American Appraisal Company and Interstate Commerce Commission indexes of construction costs show no such rise as the *Engineering News-Record* index of prices, and in 1938 were still 12 to 14 percent below the 1926 level, not only results from the greater weight given to wage rates in the *Engineering News-Record* index but also seems to indicate that the efficiency of labor in construction work has increased in recent years.

TABLE 4.—*Cost of construction for selected types of railroad construction*

[1926=100]

Year	Grading	Tunnels and subways	Bridges, trestles, and culverts	Station and office buildings	Power-plant buildings	Paving
1925	97.4	100.6	100.6	102.2	102.7	100.5
1926	100.0	100.0	100.0	100.0	100.0	100.0
1927	93.5	94.9	98.8	102.7	102.7	100.0
1928	88.2	87.1	96.5	102.2	102.7	100.0
1929	86.9	87.1	95.9	101.6	101.6	100.0
1930	80.4	80.3	88.2	98.9	95.2	100.0
1931	77.1	73.0	78.8	89.7	87.1	95.3
1932	69.3	66.9	71.8	76.6	74.2	82.1
1933	64.1	62.4	71.8	78.8	76.9	78.9
1934	65.4	68.5	80.0	82.1	79.6	76.3
1935	66.0	67.4	79.4	82.1	79.6	76.3
1936	64.7	73.0	82.9	85.3	81.7	76.3
1937	67.3	78.1	91.2	90.2	89.8	78.9
1938	60.8	79.2	88.2	90.2	89.8	78.9

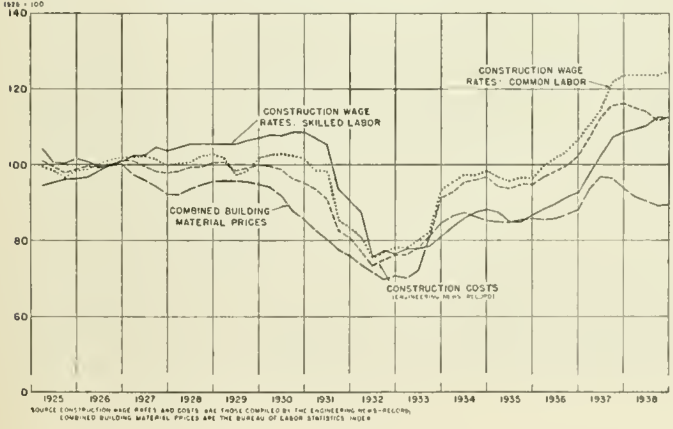
Source: Interstate Commerce Commission.

Further evidence that the spread between prices and costs in the construction industry may be due in part to the increased efficiency of labor comes from a comparison of the costs of various types of construction activity as represented by the individual indexes from which the composite Interstate Commerce Commission index was formed. Table 4 and figure 4 show cost movements from 1925–38 inclusive (with 1926 as the base year) for the following groups: Power plant buildings, station and office buildings; bridges, trestles, and culverts; tunnels and subways, paving and grading. These have been named in the order of their position as of the last year of the index, 1938. The first three groups are clustered at or near 90, which is about 11 points above paving and tunnels and subways, and nearly 30 points above grading. Since 1933 the costs of activities involving superstructures and of those involving grading, tunneling, and paving, in which excavation or the moving of dirt is an important or the principal feature, have been diverging.

An analysis of the cost trends in highway construction for the period 1926–38,[4] aside from indicating a

FIG 3

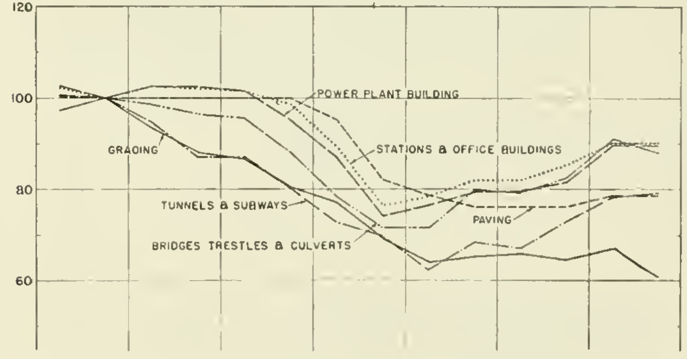
INDEXES OF CONSTRUCTION COSTS, WAGE RATES, AND COMBINED BUILDING MATERIAL WHOLESALE PRICES, 1925-1938



SOURCE CONSTRUCTION WAGE RATES AND COSTS ARE THOSE COMPILED BY THE ENGINEERING NEWS-RECORD; COMBINED BUILDING MATERIAL PRICES ARE THE BUREAU OF LABOR STATISTICS INDEX

FIG 4

COST OF CONSTRUCTION FOR SELECTED TYPES OF RAILROAD CONSTRUCTION 1925-1938



SOURCE INTERSTATE COMMERCE COMMISSION

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[3] The rise indicated by the *Engineering News-Record* between 1936 and 1938 is larger than that shown by the Bureau of Labor Statistics annual data.

[4] Indexes based on average bid prices on Federal-aid projects, prepared by the Bureau of Public Roads; see *Engineering News-Record*, Apr. 27, 1939, p. 112.

more pronounced dip in costs in 1932, corroborates the cost trends indicated in the Interstate Commerce Commission indexes. This material, presented in table 5 and figure 5, emphasizes even more the divergence between the costs for structures (which in this case include reinforcing steel, structural steel, and structural concrete) and the costs for excavation. In 1933 excavation costs stood at 70.9, surfacing 72.9, and structures 69.6; by 1938 excavation was 58.2, surfacing 75.1, and structures 84.1. It is interesting to observe that in 1938 excavation costs were even lower than in 1933; since 1934 they have been declining steadily, and in 1938 were approaching the low point of the depression year of 1932.

This movement is of significance as reflecting the influence on construction costs of technological advances and the consequent greater efficiency of labor. The effect of new inventions and of improvements in equipment is revealed by the fact that those activities which have involved the lowest costs are the same activities which have experienced the most important technological advances. A previous report of the National Resources Committee, while indicating that technological advances have been made throughout the construction industry, concludes that the most notable advances have been achieved in grading and excavation.[5] These divergences within the construction industry indicate the likelihood that the increasing gap between construction costs and prices, which was noted above, has been caused, at least partially, by the contribution of technological progress throughout the industry to increased labor efficiency.

TABLE 5.—*Cost trends in highway construction*

[1926=100]

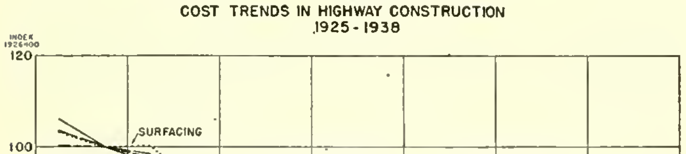
Year	Excavation	Surfacing	Structures combined [1]	Composite mile
1925	106. 1	103. 2	100. 2	103. 8
1926	100. 0	100. 0	100. 0	100. 0
1927	96. 7	100. 2	97. 9	98. 5
1928	92. 6	91. 7	92. 7	92. 2
1929	86. 8	89. 9	91. 6	89. 1
1930	83. 2	81. 6	86. 2	82. 9
1931	74. 4	73. 3	77. 0	74. 3
1932	50. 4	63. 2	65. 6	59. 0
1933	70. 9	72. 9	69. 6	71. 8
1934	79. 7	83. 4	77. 9	81. 2
1935	71. 0	82. 9	78. 6	77. 9
1936	72. 6	83. 7	86. 8	80. 2
1937	64. 3	83. 1	88. 2	76. 8
1938	58. 2	75. 1	84. 1	70. 4

[1] Includes reinforcing steel, structural steel, and structural concrete.

Source: Compiled from index of average bid prices on Federal-aid projects prepared by the Construction Division of the U. S. Bureau of Public Roads and published in the *Engineering News-Record*, Apr. 27, 1939.

FIG. 5

COST TRENDS IN HIGHWAY CONSTRUCTION
1925 - 1938



1/ INCLUDES REINFORCING STEEL, STRUCTURAL STEEL, & STRUCTURAL CONCRETE

SOURCE COMPILED FROM INDEX OF AVERAGE BID PRICES ON FEDERAL AID PROJECTS PREPARED BY THE CONSTRUCTION DIVISION OF THE U S BUREAU OF PUBLIC ROADS AND PUBLISHED IN THE ENGINEERING NEWS-RECORD APRIL 27, 1939

In conclusion, it should be emphasized again that the isolation of any one factor as a cause of price movements is a complex, if not impossible, objective. However, on the basis of the material presented above three observations can be made. First, the level of construction prices in 1937 and 1938, as indicated by the *Engineering News-Record* index, was substantially above the predepression level, whereas construction costs as indicated by the American Appraisal Co. and Interstate Commerce Commission indexes were still substantially below the predepression level. While this is due, in part, to the heavier weighting given the labor factor in the *Engineering News-Record* index, it probably also indicates a significant increase in the efficiency of construction labor. Nevertheless, costs showed an increase from 1933 to 1938 all out of proportion to the continued low level of the total volume of construction, relative to the predepression period. The second observation is that, insofar as any relationship can be adduced between construction prices and costs and the volume of construction activity, it would appear that, with the exception of 1937, movements in PWA and Federal construction expenditure have been of much more significance than movements in the volume of private, State, and local construction. Finally, a comparison of the movements of construction wage rates, building material prices, and the *Engineering News-Record* index of construction prices would appear to indicate that the large rise and current high level of the index has been due primarily to the increase in wage rates, particularly those paid to common labor. It may be presumed that the gap between construction costs and prices (other than that due to differences in weighting) has resulted from the increasing efficiency of construction labor or the substantial narrowing of profit margins. The latter, it should be noted, tend to be in the short run the most flexible of the elements entering into contract costs. In the long run, however, the gap has probably resulted for the most part from improvements in technology, a conclusion which is substantiated by the cost trends of different types of construction.

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[5] National Resources Committee, *Technological Trends and National Policy*, pt. 3, sec. IX, "Technology in the Construction Industry," p. 368:

"Although a number of factors, such as labor productivity, contractor's profits, the prices of labor and materials, and the size of projects included from year to year, enter into indexes of construction costs, they do not show the systematic differences between the various types which are clearly evident in the case of the technological factors. The construction of buildings during the past 15 years has experienced a number of technical improvements but, excepting those of the past year or two, they have not been conspicuous. However, grading and excavation for highways and railroads, * * * has seen a notable series of developments in the introduction of new equipment, such as wheel scrapers, pneumatic-tired trucks of large capacity, loading machines, and heavy tractors. Power shovels have also increased greatly in mobility, ruggedness, speed, and economy of operation, as well as in size. The largest shovels are actually much too large for most construction operations (they have a capacity only slightly less than that of an ordinary freight car) and are used for stripping purposes in open-pit coal-mining operations. * * * Major improvements in highway bridge structures both concrete and steel are well known, but excepting in the longer and heavier spans, have not been as notable as have been the technical changes in grading and excavating."

Building Material Prices and Federal Material Orders

We now turn from consideration of the general costs of construction to a discussion of the principal components of those costs, in particular building material prices and wage rates. In the following sections the developments in these two fields will be traced and related so far as possible to material orders and wage payments in federally financed construction.

Table 6 and figure 6 show, annually from 1925 to 1932, and quarterly from 1933 to 1938, the movements in the indexes of the wholesale prices of combined building materials, and of all wholesale prices, as compiled by the Bureau of Labor Statistics; and also from 1933 to 1938 they show the quarterly volume of all material orders on projects financed wholly or partially from Federal (including PWA) funds. It will be observed that since 1930 building material prices have been substantially above wholesale prices in general. By the first quarter of 1933 the building materials had declined to only 70, compared with a decline to 60 in the case of wholesale prices in general. The rise in building material prices in 1933 and 1934 was considerably sharper than that in all wholesale prices, but subsequently, up to 1937, material prices levelled off and declined somewhat, whereas all prices continued an upward trend. In 1938 the decline in building material prices was much less pronounced than in all wholesale prices, and at the end of the year the two indexes stood at 89.5 and 77.4, respectively. However, the general similarity in the trends of the two indexes makes it unwise to attribute any strong effect to the movements in federally financed material orders in the period 1933 to 1938. Nevertheless, three possibilities should be mentioned. First, the somewhat sharper rise in building material prices in the latter half of 1933 and early 1934 may have been stimulated in part by the sharply rising volume of PWA orders as the emergency public works program got under way. Secondly, the considerably smaller decline in building material prices in 1938, and the upward turn in the latter half of the year,

Table 6.—*Wholesale prices of combined building materials and of all commodities compared with movements in total material orders on projects financed wholly or partially from PWA and all Federal funds*

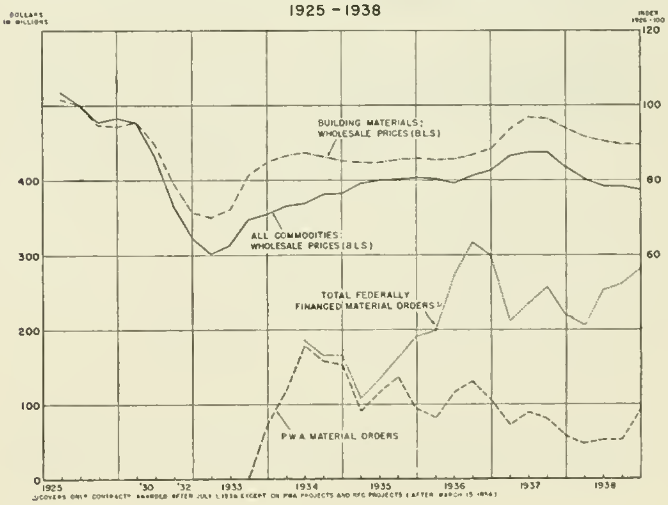
Year and quarter	PWA material orders	Total Federal material[1] orders	Building materials—wholesale prices (BLS.) (1926=100)	All commodities—wholesale prices (BLS.) (1926)=100)
	Millions of dollars	*Millions of dollars*		
1925			101.7	103.5
1926			100.0	100.0
1927			94.7	95.4
1928			94.1	96.7
1929			95.4	95.3
1930			89.9	86.4
1931			79.2	73.0
1932			71.4	64.8
1933:				
First			70.1	60.3
Second			72.1	62.7
Third	1.6		81.2	69.7
Fourth	74.0		84.8	71.0
1934:				
First	118.4		86.4	73.2
Second	179.7		87.3	73.9
Third	158.5	166.2	86.1	76.3
Fourth	153.5	166.3	85.1	76.6
1935:				
First	96.6	109.7	84.9	79.2
Second	116.6	133.6	84.9	80.0
Third	137.1	168.2	85.5	80.2
Fourth	94.9	191.1	85.8	80.7
1936:				
First	81.3	198.9	85.5	80.3
Second	116.6	272.6	85.8	79.2
Third	130.6	317.3	85.9	81.2
Fourth	105.1	298.8	88.2	82.7
1937:				
First	72.7	212.2	93.5	86.7
Second	89.9	235.2	96.9	87.5
Third	80.3	256.3	96.4	87.6
Fourth	56.2	220.2	93.9	83.5
1938:				
First	47.1	205.6	91.5	80.1
Second	51.2	253.4	90.4	78.4
Third	52.0	262.0	89.4	78.4
Fourth	91.3	280.6	89.5	77.4

[1] Covers only contracts awarded after July 1, 1934.

Source: Bureau of Labor Statistics.

FIG 6

WHOLESALE PRICES OF COMBINED BUILDING MATERIALS AND OF ALL COMMODITIES COMPARED WITH MOVEMENTS IN TOTAL MATERIAL ORDERS ON PROJECTS FINANCED WHOLLY OR PARTIALLY FROM PWA. AND ALL FEDERAL FUNDS 1925 - 1938



1/ COVERS ONLY CONTRACTS AWARDED AFTER JULY 1, 1934 EXCEPT ON PWA PROJECTS AND RFC PROJECTS (AFTER MARCH 15 1934) in contrast to the continued decline in all wholesale prices, may well have been related to the increasing volume of federally financed orders during that year. Finally, the fact that from 1933–38 building material prices were maintained well above wholesale prices generally may have been due in part to the substantial support provided by federally financed orders in this field as compared with other commodity classifications.

In table 7 and figure 7, the wholesale price index of combined building materials is compared with the wholesale price indexes of six specific building materials, namely, brick and tile, cement, lumber, structural steel, vitrified sewer pipe, and cast-iron pipe. It will be noted that a considerable spread exists among these various indexes. In general, the indexes of wholesale cement and structural steel prices remain consistently above the others; they did not decline as far in 1930 to 1932 and they rose to a higher level in the subsequent 6 years. On the other hand, the wholesale price indexes of lumber and sewer pipe tended to remain below the others. The degree of monopoly or of monopolistic price policy in these industries is probably of considerable significance in explaining these variations in price trends—the stable cement price after 1935 is especially in point; the stability, it is to be noted, was at a level approximately as high as existed in 1925–29.

In figures 8 to 13 price indexes for six types of building materials are compared with the volume of federally financed orders of the same or similar materials and, where available, with the volume of total production.[6] Again the greatest caution must be observed in attributing causal effect to movements in federally financed orders so far as these short-term price changes are concerned. There appears to be little general relation-

TABLE 7.—*Wholesale prices of selected building materials, 1925–38*

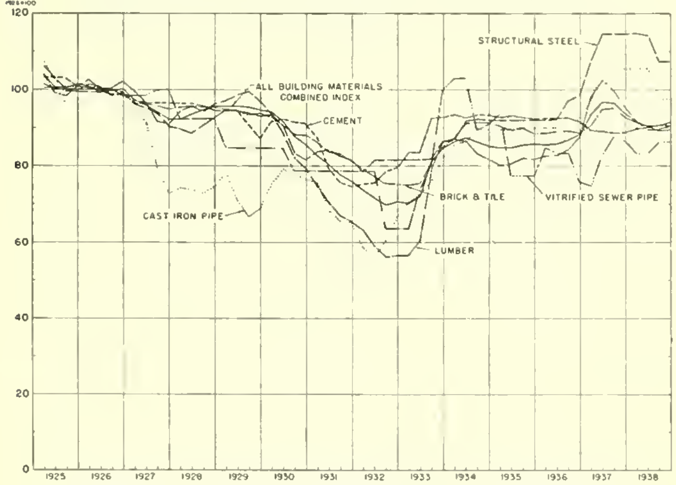
[1926=100]

	Combined building materials	Structural steel	Cement	Lumber	Brick and tile	Cast-iron pipe	Vitrified sewer pipe
1925	101.7	102.2	102.6	100.6	100.1	102.8	100
1926	100.0	100.0	100.0	100.0	100.0	100.0	100
1927	94.7	94.7	95.4	93.1	95.7	84.8	100
1928	94.1	95.2	92.5	90.5	95.6	73.9	92.4
1929	95.4	98.1	89.0	93.8	94.3	71.3	84.8
1930	89.9	87.3	89.8	85.8	89.8	77.2	81.8
1931	79.2	83.1	74.8	69.5	83.6	68.7	78.9
1932	71.4	80.9	74.3	58.5	77.3	60.5	71.2
1933	77.0	83.1	88.1	70.7	79.2	75.2	78.9
1934	86.2	90.8	93.1	84.5	90.2	87.8	97.0
1935	85.3	92.0	92.7	81.1	89.4	89.8	81.8
1936	86.7	95.0	92.2	84.5	88.7	91.0	81.8
1937	95.2	113.2	89.0	99.0	93.5	103.5	83.3
1938	90.3	111.0	90.3	90.4	91.0	101.5	84.8

Source: The price index of vitrified sewer pipe is based on the New York delivered price for 12-inch, single-strength pipe as given in the *Engineering News-Record;* that for cast-iron pipe is the New York price of 6-inch pipe as given in the *Iron Age.* The other indexes are compilations of the Bureau of Labor Statistics. The cement index is on a delivered price basis.

FIG 7

WHOLESALE PRICES OF SELECTED BUILDING MATERIALS, 1925-1938



SOURCE: THE PRICE INDEX OF VITRIFIED SEWER PIPE IS BASED ON THE NEW YORK DELIVERED PRICES FOR 12 INCH SINGLE STRENGTH PIPE AS GIVEN IN THE ENGINEERING NEWS RECORD THAT FOR CAST IRON PIPE IS THE NEW YORK PRICE OF 6 INCH PIPE AS GIVEN IN THE IRON AGE THE OTHER INDEXES ARE COMPILATIONS OF THE BUREAU OF LABOR STATISTICS

TABLE 8.—*Estimated average hourly earnings on construction, road building, and in all industries, 1925–38*

[Dollars per hour]

Year and quarter	Construction		All industries (NICB)	Road building common labor (BPR)
	Common labor (ENR)	Skilled labor (ENR)		
1925:				
First	0.545	1.21	0.560	0.37
Second	.538	1.22	.563	.38
Third	.530	1.23	.559	.38
Fourth	.540	1.23	.561	.38
1926:				
First	.541	1.24	.562	.36
Second	.548	1.26	.568	.38
Third	.554	1.28	.570	.39
Fourth	.553	1.29	.573	.39
1927:				
First	.559	1.31	.573	.38
Second	.560	1.31	.577	.40
Third	.555	1.34	.578	.40
Fourth	.547	1.33	.577	.40
1928:				
First	.549	1.34	.574	.38
Second	.552	1.35	.578	40
Third	.560	1.35	.581	.42
Fourth	.564	1.35	.583	.41
1929:				
First	.558	1.35	.586	.37
Second	.532	1.35	.591	.39
Third	.538	1.36	.590	.40
Fourth	.558	1.37	.592	.40
1930:				
First	.562	1.38	.592	.39
Second	.564	1.38	.592	.40
Third	.561	1.39	.590	.40
Fourth	.556	1.39	.582	.38
1931:				
First	.539	1.37	.575	.37
Second	.538	1.35	.571	.36
Third	.467	1.20	.565	.35
Fourth	.456	1.16	.545	.34
1932:				
First	.443	1.12	.530	.33
Second	.412	.97	.505	.33
Third	.422	.99	.485	.32
Fourth	.428	.98	.470	.37

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[6] Comparability has been attained by the use of an arbitrary scale whereby a 1 percent change in price (1935=100) is equivalent to 2 percent of 1935 production.

TABLE 8.—*Estimated average hourly earnings on construction, road building, and in all industries, 1925–38*—Continued

Year and quarter	Construction		All industries (NICB)	Road building common labor (BPR)
	Common labor (ENR)	Skilled labor (ENR)		
1933:				
First	0.428	0.99	0.462	0.34
Second	.439	.99	.454	.35
Third	.446	1.00	.500	.36
Fourth	.512	1.04	.546	.44
1934:				
First	.523	1.06	.558	.42
Second	.534	1.09	.584	.43
Third	.532	1.11	.589	.41
Fourth	.539	1.12	.594	.41
1935:				
First	.529	1.11	.595	.39
Second	.525	1.08	.599	.41
Third	.529	1.08	.601	.42
Fourth	.528	1.10	.604	.42
1936:				
First	.547	1.12	.609	.36
Second	.558	1.14	.615	.38
Third	.567	1.16	.618	.39
Fourth	.584	1.18	.627	.39
1937:				
First	.606	1.24	.646	.36
Second	.628	1.30	.697	.39
Third	.668	1.36	.713	.42
Fourth	.677	1.38	.716	.41
1938:				
First	.677	1.39	.711	.33
Second	.676	1.40	.718	.39
Third	.677	1.43	.713	.42
Fourth	.682	1.43	.714	.40

Sources: Construction wage rates are those compiled by the *Engineering News-Record;* road building rates are those compiled by the Bureau of Public Roads; average hourly earnings in all industries are the estimates of the National Industrial Conference Board.

ship between federally financed orders and prices, although in specific cases there may be some effect. The rise in the price of cast-iron pipe in 1933 and 1934, although total production was declining, may be related to federally financed orders; so also may the rise in cement prices in 1933 and 1934 and the rise in the price of concrete sewer pipe in 1938, when federally financed orders for concrete products were similarly increasing.

It is, perhaps, significant to observe the timing of these federally financed orders in relation to individual prices. In every case the peak of federally financed orders occurred in the middle of 1936 when production in general was also high and when, in most cases, a large and partly speculative price rise was beginning. Similarly, in the latter part of 1937 and early 1938, federally financed orders, and particularly PWA orders, fell off although private demand was also declining.

Hourly Earnings on Construction

The other principal constituent of construction costs is wage payments. Table 8 and figure 14 show, from 1926 to 1938, movements in construction wage rates for common and skilled labor (*Engineering News-Record*), road building wage rates for common labor (Bureau of Public Roads), and average hourly earnings in all industries (National Industrial Conference Board). It will be observed that wage rates in the construction industry followed very closely the pattern of wage rates in all industries, except that construction wage rates, particularly those for skilled labor, appear to be some-

MOVEMENTS IN PRICE COMPARED WITH ORDERS ON PROJECTS FINANCED WHOLLY OR PARTIALLY FROM PWA AND ALL FEDERAL FUNDS[1]

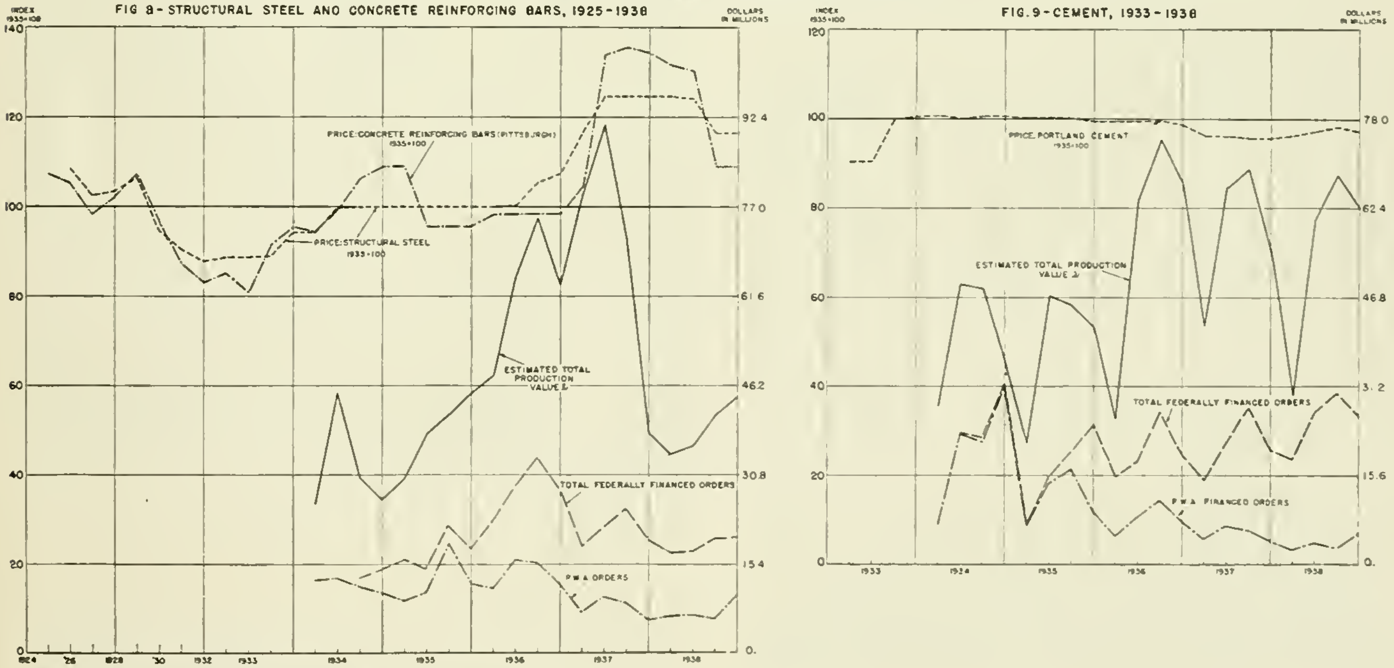


FIG 8 - STRUCTURAL STEEL AND CONCRETE REINFORCING BARS, 1925-1938

FIG. 9 - CEMENT, 1933 - 1938

1/ COVERS ONLY CONTRACTS AWARDED ON REGULAR FEDERAL PROJECTS AFTER JULY 1, 1934 AND ON RFC PROJECTS AFTER MARCH 13, 1934
2/ INCLUDES AN ALLOWANCE OF 6% OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS
3/ INCLUDES AN ALLOWANCE OF 26% OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS
SOURCE: PWA AND FEDERAL ORDERS ARE FROM THE BUREAU OF LABOR STATISTICS. PRICES FOR STRUCTURAL STEEL ARE FROM THE BUREAU OF LABOR STATISTICS AND FOR CONCRETE REINFORCING BARS-PITTSBURGH FROM THE ENGINEERING NEWS-RECORD. PRICES FOR CEMENT ARE THOSE GIVEN IN SURVEY OF CURRENT BUSINESS

MOVEMENTS IN PRICE COMPARED WITH ORDERS ON PROJECTS FINANCED WHOLLY OR PARTIALLY FROM P.W.A AND ALL FEDERAL FUNDS,[1]

1933-1938

FIG.10-LUMBER AND TIMBER PRODUCTS

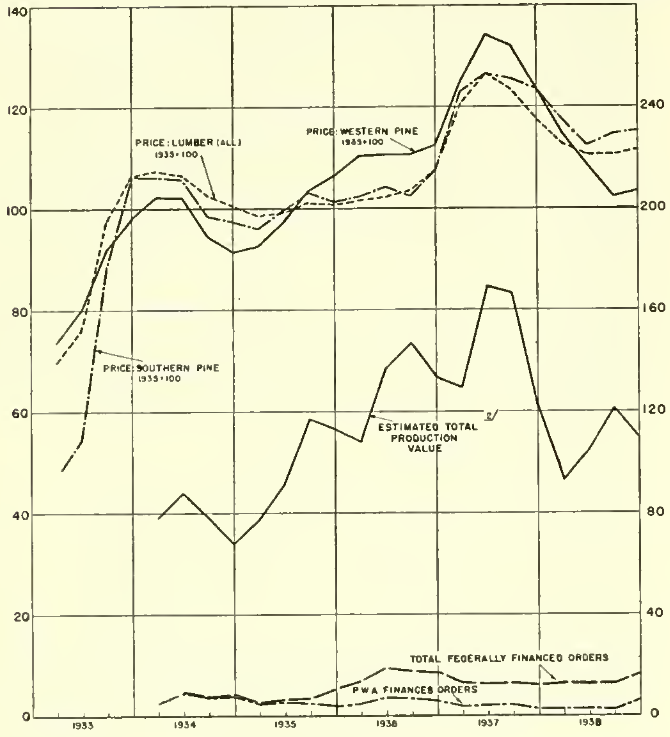


FIG.11-BRICK AND TILE, ALL CLAY PRODUCTS

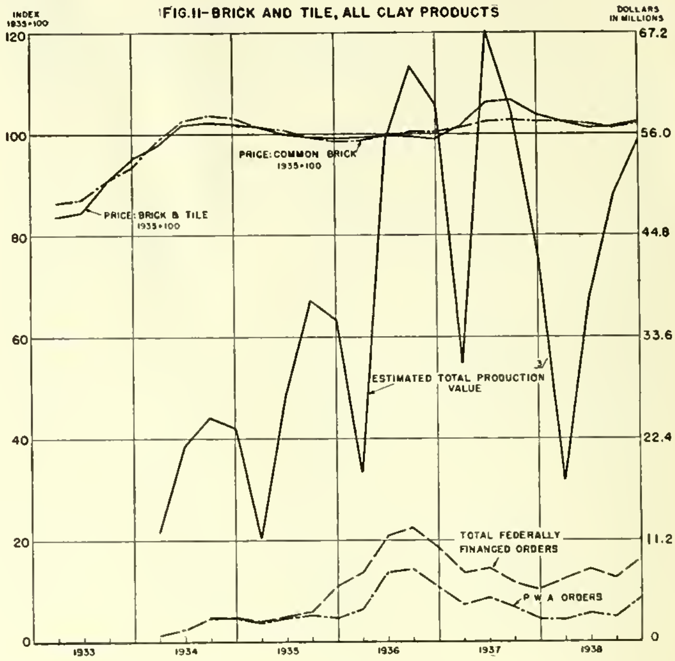


FIG 12-CAST IRON PIPE AND FITTINGS

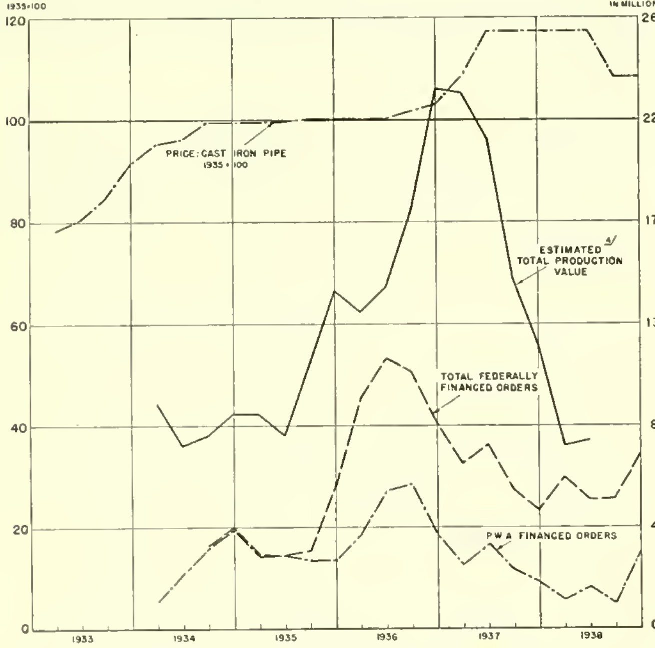
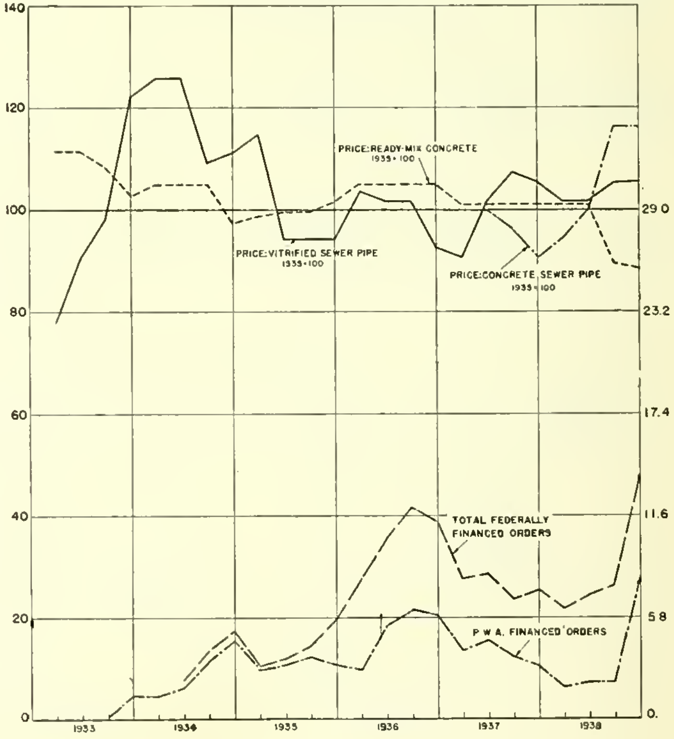


FIG. 13-VITRIFIED AND CONCRETE SEWER PIPE AND READY-MIX CONCRETE



[1] COVERS ONLY CONTRACTS AWARDED ON REGULAR FEDERAL PROJECTS AFTER JULY 19 1934 AND ON R F. C. PROJECTS AFTER MARCH 16. 1934.

[2] INCLUDES AN ALLOWANCE OF 28 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS.

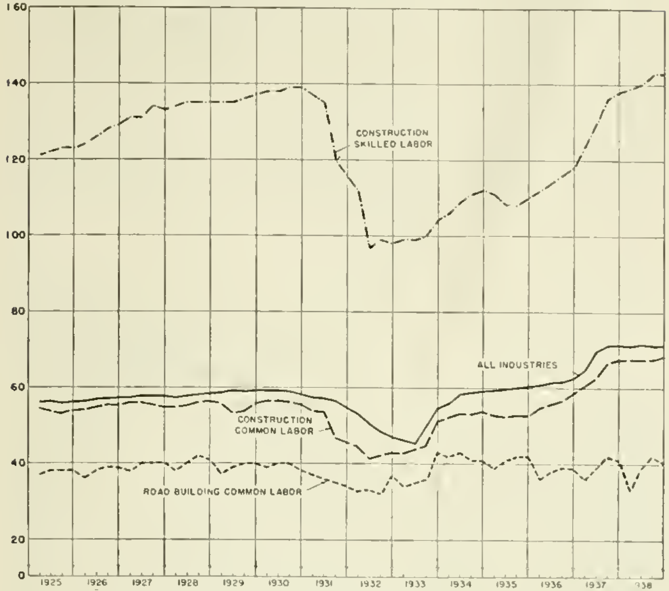
[3] INCLUDES AN ALLOWANCE OF 20 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS.

[4] INCLUDES AN ALLOWANCE OF 8 PERCENT OF TOTAL DELIVERED VALUE FOR DELIVERY COSTS.

SOURCE. P. W. A. AND FEDERAL ORDERS ARE FROM THE BUREAU OF LABOR STATISTICS PRICES; PWA AND FEDERAL ORDERS IN FIG. 11 COVER ALL CLAY PRODUCTS. ALL LUMBER, BRICK, AND TILE, FROM BUREAU OF LABOR STATISTICS; VITRIFIED AND CONCRETE SEWER PIPE AND READY-MIX CONCRETE (BASED ON NEW YORK DELIVERIES) FROM ENGINEERING NEWS-RECORD; CEMENT, WESTERN AND SOUTHRN PINE, COMMON BRICK, FROM SURVEY OF CURRENT BUSINESS. CAST-IRON PIPE (FOR NEW YORK ELIVERIES OF 6-INCH PIPE) FROM IRON AGE.

FIG 14

ESTIMATED AVERAGE HOURLY EARNINGS ON CONSTRUCTION, ROAD BUILDING, AND IN ALL INDUSTRIES, 1925–1938



SOURCE CONSTRUCTION WAGE RATES COMPILED BY ENGINEERING NEWS-RECORD, ROAD BUILDING RATES COMPILED BY BUREAU OF PUBLIC ROADS, AVERAGE HOURLY EARNINGS IN ALL INDUSTRIES ARE ESTIMATES OF THE NATIONAL INDUSTRIAL CONFERENCE BOARD

what more flexible than wage rates in general. In 1938, wage rates in both construction and all industries were from 8 to 20 percent above the predepression level. In contrast to the other indexes, that for common labor on road building projects, as compiled by the Bureau of Public Roads, shows only minor fluctuations and actually declined somewhat from 1934 to 1938.

Figure 15 compares an index of hourly earnings in all industries with the indexes of earnings in seven specific construction materials industries, using 1935 as the base year. It is readily apparent that there were no significant or substantial variations, during the period 1933 to 1938, in the movements of the various indexes.

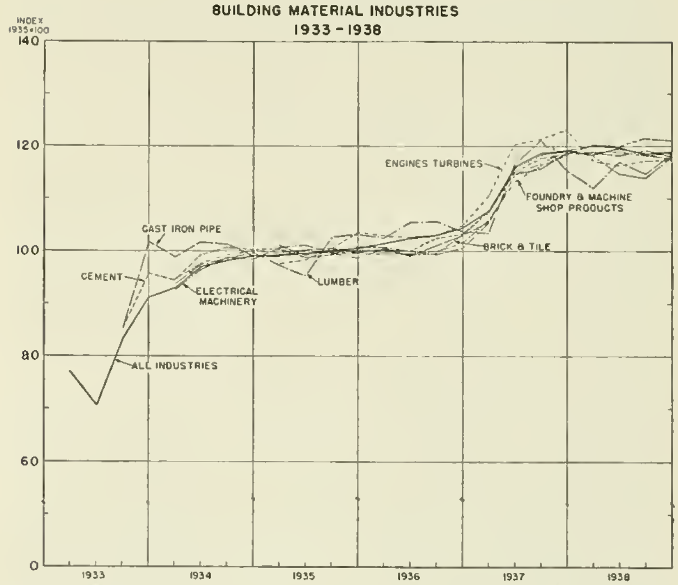
By means of the reported figures on man-hours and pay rolls for the various programs of federally financed construction, it is possible to determine the average hourly earnings on PWA, regular Federal, and WPA construction. These are compared with the wage rates for skilled and common construction labor, as compiled by the *Engineering News-Record*, in table 9 and figure 16. The PWA earnings are somewhat above those on regular Federal construction, indicating possibly that a higher proportion of skilled labor is used on PWA projects and reflecting also the frequent use of force account labor on regular Federal construction. On the other hand, the hourly earnings on WPA construction are substantially lower than those for PWA and regular Federal construction and lower than for common labor generally. This follows from the large proportion of unskilled relief workers used on WPA projects.

It is interesting to observe that the hourly earnings on PWA and regular Federal construction tended for the most part to follow the general trend. However,

FIG 15

AVERAGE HOURLY EARNINGS IN ALL INDUSTRIES AND IN SEVEN SELECTED BUILDING MATERIAL INDUSTRIES

1933 - 1938



SOURCE BUREAU OF LABOR STATISTICS, EXCEPT FOR EARNINGS IN ALL INDUSTRIES WHICH ARE ESTIMATES OF THE NATIONAL INDUSTRIAL CONFERENCE BOARD

TABLE 9.—*Average hourly earnings on PWA, regular Federal, and WPA construction, compared with estimated average wage rates on all construction*

[In dollars per hour]

Year and quarter	Construction wage rates: common labor	Construction wage rates: skilled labor	Average hourly earnings on PWA construction	Average hourly earnings on regular Federal construction	Average hourly earnings on WPA construction
1933:					
First	0.428	0.99			
Second	.439	.99			
Third	.446	1.00	0.557		
Fourth	.512	1.04	.533		
1934:					
First	.523	1.06	.545		
Second	.534	1.09	.565		
Third	.532	1.11	.591	0.536	
Fourth	.539	1.12	.636	.548	
1935:					
First	.529	1.11	.679	.586	
Second	.525	1.08	.668	.667	
Third	.529	1.08	.687	.632	0.503
Fourth	.528	1.10	.737	.612	.461
1936:					
First	.547	1.12	.752	.632	.414
Second	.558	1.14	.749	.629	.444
Third	.567	1.16	.772	.662	.492
Fourth	.584	1.18	.797	.680	.502
1937:					
First	.606	1.24	.823	.729	.507
Second	.628	1.30	.803	.700	.514
Third	.668	1.36	.816	.683	.523
Fourth	.677	1.38	.845	.703	.524
1938:					
First	.677	1.39	.821	.730	.504
Second	.676	1.40	.814	.715	.501
Third	.677	1.43	.840	.699	.503
Fourth	.682	1.43	.854	.703	.497

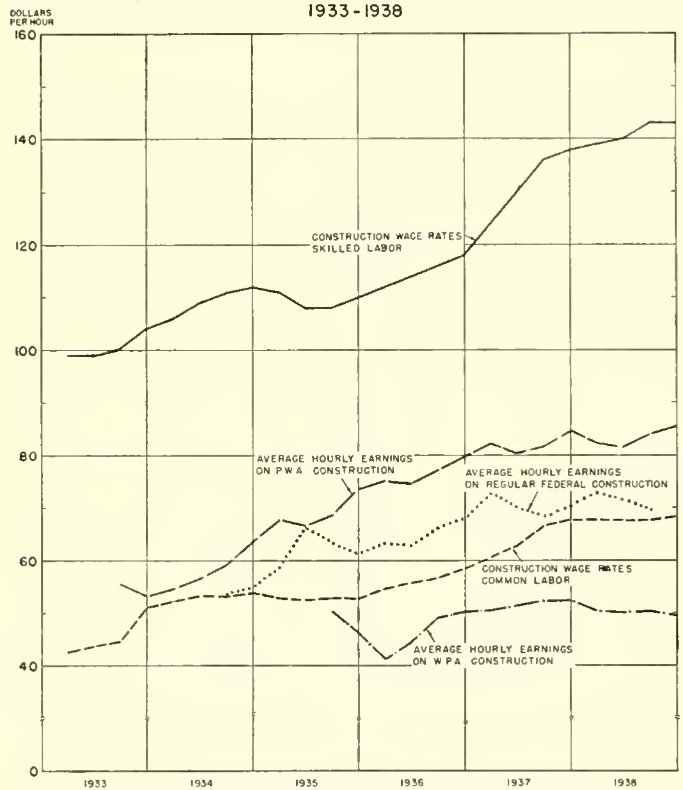
Source: Wage rates are those compiled by the *Engineering News-Record*. Average hourly earnings were calculated by the Bureau of Labor Statistics on the basis of reported volume of payrolls and man-hours.

in 1935, hourly earnings on PWA projects continued to rise, whereas construction wage rates declined somewhat. On the other hand, in 1937 and 1938, hourly earnings on regular Federal and PWA projects leveled off, although hourly wage rates generally showed a substantial rise. Hourly earnings on WPA projects remained practically unchanged from the middle of 1936 onwards. There is nothing in these aggregate figures to justify the frequent charge that PWA wage policies have forced up prevailing wage-rate levels, or that WPA work has offered a level of remuneration competitive with that in private construction work. Final conclusions cannot be reached because it has been necessary to rely on averages.

A significant distortion may be involved in these comparisons as a result of the different types of projects in regular Federal and PWA construction, as compared with the aggregate construction on which the *Engineering News-Record* wage rates are calculated. Consequently, a more accurate comparison may be that of the hourly earnings on one type of construction work. Table 10 and figure 17 show the average hourly earnings on building construction generally, as compiled by the Bureau of Labor Statistics, and the average hourly earnings on regular Federal, WPA, and PWA building projects. It will be observed that the general trend of wages on building construction was fairly level in 1934–35, rose substantially in 1936–37, and declined a little in 1938. Earnings on WPA building construction averaged around 25 cents less (nearly 30 percent) than on building construction generally. Earnings on building projects financed from regular Federal appropriations also were substantially below the general rates

FIG 16

AVERAGE HOURLY EARNINGS ON P.W.A., REGULAR FEDERAL, AND W.P.A. CONSTRUCTION, COMPARED WITH ESTIMATED AVERAGE WAGE RATES ON ALL CONSTRUCTION. 1933-1938



SOURCE WAGE RATES ARE THOSE COMPILED BY THE ENGINEERING NEWS-RECORD AVERAGE HOURLY EARNINGS WERE CALCULATED BY THE BUREAU OF LABOR STATISTICS ON THE BASIS OF REPORTED VOLUMES OF PAYROLLS AND MAN-HOURS

TABLE 10.—*Average hourly earnings on PWA, regular Federal and WPA building projects, compared with earnings on building construction in general*

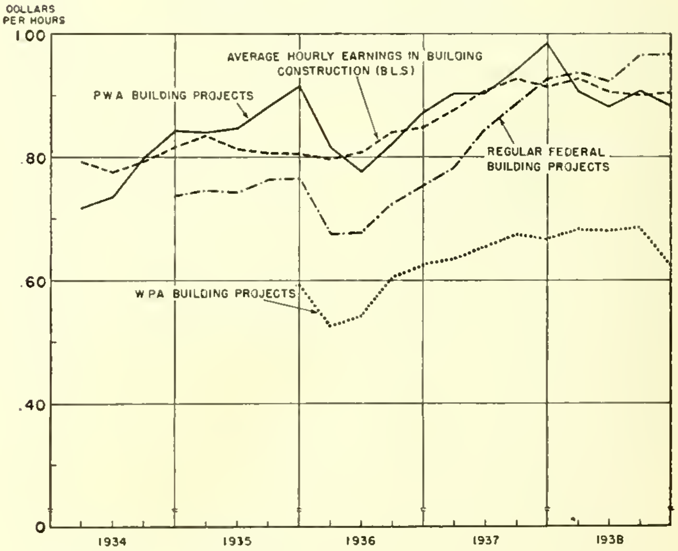
[In dollars per hour]

Year and quarter	PWA building projects	WPA building projects	Regular Federal building projects	Average hourly earnings on building construction
1934:				
First	0.719			0.791
Second	.735			.778
Third	.799			.795
Fourth	.843		0.739	.818
1935:				
First	.840		.746	.835
Second	.847		.743	.813
Third	.882		.763	.806
Fourth	.916	0.591	.766	.805
1936:				
First	.816	.526	.677	.799
Second	.776	.542	.679	.809
Third	.821	.604	.725	.840
Fourth	.872	.627	.754	.848
1937:				
First	.903	.635	.781	.878
Second	.903	.651	.844	.905
Third	.941	.672	.885	.928
Fourth	.985	.667	.927	.914
1938:				
First	.908	.681	.938	.928
Second	.881	.680	.923	.905
Third	.909	.685	.965	.900
Fourth	.882	.625	.967	.904

Source: Bureau of Labor Statistics.

FIG. 17

AVERAGE HOURLY EARNINGS ON P.W.A., REGULAR FEDERAL, AND W.P.A. BUILDING PROJECTS, COMPARED WITH EARNINGS ON BUILDING CONSTRUCTION IN GENERAL



SOURCE · BUREAU OF LABOR STATISTICS

up to 1938; again this differential probably results from the frequent use of force-account labor (directly supervised construction rather than contract work), as on Army posts and Indian reservations, and the location of many regular Federal projects in localities where only nonunion labor exists. In the latter half of 1938, earnings on Federal projects moved above earnings in general; however, this seems to have been because many of the projects in this category had reached later stages of completion. As we shall see below, as projects progress toward completion, a larger amount of skilled labor, and, consequently, a higher average wage rate, is characteristic.

Hourly earnings on PWA building projects started out somewhat below the prevailing level, as indicated by the Bureau of Labor Statistics figures on average building wage rates. Thereafter, the PWA rates fluctuated around the prevailing average, not moving substantially above or below, except in the latter part of 1935. However, subsequent investigation has shown that this average for the PWA programs as a whole is not as significant as a break-down by the individual programs. Table 11 and figure 18 show the average hourly earnings on NIRA Federal and non-Federal projects, projects (all non-Federal) financed through the ERA acts of 1935, 1936, and 1937, and Federal and non-Federal projects financed under the 1938 program.

TABLE 11.—*Average hourly earnings on PWA building projects, according to program and Federal or non-Federal auspices*

[In dollars per hour]

Year and quarter	NIRA Federal projects (1933 program)	NIRA non-Federal projects (1933 program)	ERAA non-Federal projects (1935, 1936, 1937 programs)	PWAA 1938 Federal projects (1938 program)	PWAA 1938 non-Federal projects (1938 program)	Average hourly earnings, building construction (BLS)
1934:						
First	0.684	0.834	----------	----------	----------	0.791
Second	.708	.812	----------	----------	----------	.778
Third	.773	.830	----------	----------	----------	.795
Fourth	.796	.873	----------	----------	----------	.818
1935:						
First	.749	.884	----------	----------	----------	.835
Second	.758	.879	----------	----------	----------	.813
Third	.798	.906	----------	----------	----------	.806
Fourth	.853	.937	0.651	----------	----------	.805
1936:						
First	.746	.940	.699	----------	----------	.799
Second	.808	.929	.733	----------	----------	.809
Third	.866	.929	.797	----------	----------	.840
Fourth	.905	.915	.853	----------	----------	.848
1937:						
First	.927	.971	.891	----------	----------	.878
Second	.886	.982	.896	----------	----------	.905
Third	[1] 1.029	[1] 1.007	.929	----------	----------	.928
Fourth	1.125	1.088	.964	----------	----------	.914
1938:						
First	1.143	1.125	.914	----------	----------	.928
Second	1.180	1.122	.865	----------	----------	.905
Third	1.131	1.110	.911	0.793	0.786	.900
Fourth	1.169	1.244	.931	.842	.829	.904

[1] After the middle of 1937 the rates on the NIRA projects are largely meaningless for comparative purposes, since only a few large projects involving an exceptional amount of skilled labor in their final stages remained.

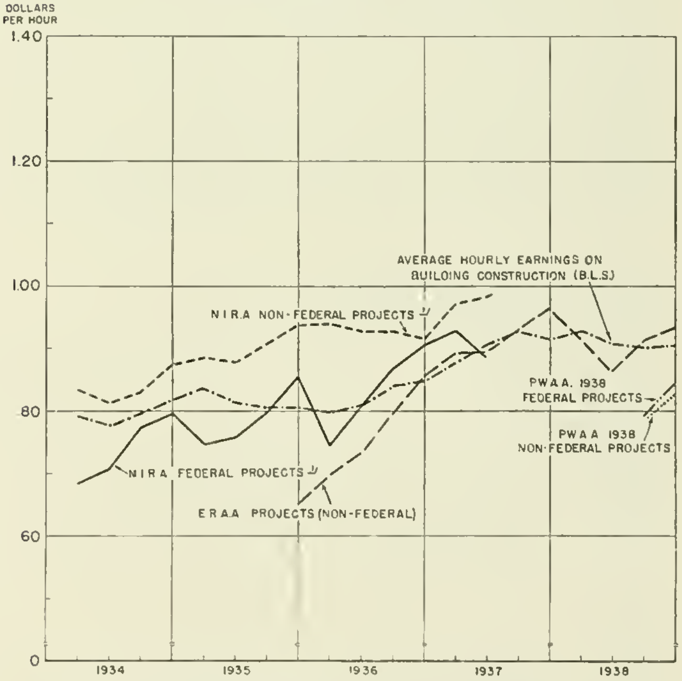
Source: Bureau of Labor Statistics. The non-Federal NIRA classification was revised by omitting the Queen's midtown tunnel, Hudson River midtown tunnel, Triborough Bridge, and Philadelphia subway projects.

First of all, hourly earnings tend to start at a low level as the programs get underway, when the preliminary work involving a relatively large amount of unskilled labor is carried on, and subsequently to rise as more and more skilled labor is required on the projects. Thus, for example, the earnings on ERA projects (1935–37 programs) started at about 65 cents, about 15 cents below the prevailing level in the country as a whole, and then rose to the prevailing level by the end of 1936. Similarly, the average hourly earnings on both Federal and non-Federal projects under the 1938 program started out at a level roughly comparable to the original NIRA program and substantially below the prevailing rates. The earnings on NIRA Federal and non-Federal projects are largely meaningless for generalization after the middle of 1937, since only a few large projects, involving an exceptional proportion of skilled labor in the final stages, remained incomplete.

More important, however, are the apparent differences in the programs themselves. The hourly earnings on the programs subsequent to the NIRA were frequently below and never significantly above the prevailing level. Furthermore, the hourly earnings on

FIG 18

AVERAGE HOURLY EARNINGS ON P.W.A. BUILDING PROJECTS, ACCORDING TO PROGRAM AND FEDERAL OR NON-FEDERAL AUSPICES



[1] AFTER THE MIDDLE OF 1937, THE RATES ON THE N I R A PROJECTS ARE LARGELY MEANINGLESS FOR COMPARATIVE PURPOSES SINCE ONLY A FEW LARGE PROJECTS, INVOLVING AN EXCEPTIONAL AMOUNT OF SKILLED LABOR IN THE FINAL STAGES, REMAINED.

SOURCE: BUREAU OF LABOR STATISTICS THE NON-FEDERAL N.I.R.A. CLASSIFICATION WAS REVISED BY OMITTING THE QUEENS MIDTOWN TUNNEL, HUDSON RIVER MIDTOWN TUNNEL, TRIBOROUGH BRIDGE, AND PHILADELPHIA SUBWAY PROJECTS

NIRA Federal projects were likewise below or around the prevailing level, except after the middle of 1937 when, as was noted above, the earnings became meaningless for purposes of comparison. Non-Federal NIRA projects, however, apparently provided hourly earnings from the beginning well above the prevailing level and above the earnings on the other programs. The hourly earnings on NIRA non-Federal projects from 1934 to the middle of 1937 (using an average of the quarterly averages) was 90.2 cents, compared with an average of 82.3 cents for the prevailing rates and of 80.4 cents on NIRA Federal projects.

This discrepancy between the hourly earnings on the NIRA non-Federal projects and on other PWA construction and on construction generally was apparently due to the official wage rate policy of the PWA authorities on the NIRA program. For this program minimum wage rates were set in each of three zones. In the southern zone, at least, these minimums were apparently above the levels prevailing for the different types of construction labor in many specific localities. Furthermore, an additional provision was made that, in places where union wage agreements existed, the wages on PWA projects were not to be less than the wages stipulated in such agreements as of April 30, 1933. Since the wage agreements were customarily revised annually in May, this provision had the general effect of fixing wage rates for union labor on NIRA projects at a minimum of the 1932 levels. The provision applied only to contract work, and the only apparent reason for the large difference between the rates on non-Federal and Federal NIRA projects arises from the fact that, on a portion of the latter, use was made of force-account labor. On the PWA programs subsequent to the NIRA, the wage regulations merely stipulated that the minimum should be that required under State laws, where such existed, or otherwise the wage rates prevailing in the locality.

The Effect of Public Works Timing on Contract Prices

The possibility was mentioned above that public works construction activity may have a more unfavorable effect on costs than an equivalent volume of private construction activity. This possibility would appear to arise primarily from the nature of the timing of public works programs and from the methods by which the programs have been inaugurated and carried out.[7] In 1933 and 1938, as has been pointed out elsewhere, the efforts to raise the level of public works construction were undertaken after a substantial decline in employment and private activity had occurred, and consequently there was considerable pressure for the projects to be put under way as speedily as possible. It is probable that this pressure for getting the programs under way resulted in the bunching of bid invitations and contract awards over short intervals of time, with an effect on cost quite different from what might have resulted from a more gradual, less apparent, and less publicized rise in private construction.

An analysis has been made for this study, by the Public Works Administration, of the timing of contract awards in three localities, namely, Los Angeles County, Calif.; Hamilton County, Ohio (Cincinnati); and Lancaster County, Nebr. (Lincoln). In addition, information has been obtained with respect to the value of contracts on non-Federal projects in force in Maryland over the period 1933 to 1936. Table 12 and figure 19 show, monthly and cumulatively by months since 1933, the percentage of the total value of contracts awarded on all PWA projects in each of the first three localities, respectively. The date used is that of the official PWA approval of the contract. Table 13 and figure 20 show the value of contracts on non-Federal PWA projects in force in Maryland from 1933 to 1936.

TABLE 12.—*Percentoge of total value of all contracts awarded on PWA projects, cumulatively by months, for 3 selected counties,[1] 1933–38*

	Los Angeles County, Calif.	Hamilton County, Ohio	Lancaster County, Nebr.
1933			
October	0.1	2.9	----------
November	.3	2.9	----------
December	.5	6.4	----------
1934			
January	2.6	7.3	----------
February	2.8	9.9	5.0
March	3.5	10.0	5.0
April	3.8	12.6	10.5
May	4.0	13.3	14.6
June	4.5	15.5	14.6
July	5.5	17.3	14.6
August	6.0	18.0	17.9
September	7.1	20.4	30.1
October	7.7	21.4	30.1
November	9.5	21.5	30.1
December	11.2	21.5	30.1
1935			
January	13.6	23.5	37.2
February	15.6	23.5	37.4
March	19.8	23.5	38.5
April	23.6	24.1	38.5
May	25.3	24.1	39.7
June	26.9	25.1	39.7
July	31.9	25.1	39.7
August	34.4	25.1	39.7
September	35.7	25.2	39.7
October	36.1	25.2	39.7
November	37.8	29.4	41.3
December	38.4	43.3	45.2

See footnotes at end of table.

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[7] There are other reasons for a difference between public and private construction in their effect upon costs. Some private construction may wait upon falling costs and some may be curtailed with increases in costs. Public construction (this was certainly true of the Federal activities of recent years) is more likely to be scheduled for a given time and undertaken as planned even though costs have changed. Under such circumstances public construction may be expected to have a greater sustaining effect on costs than would private activity.

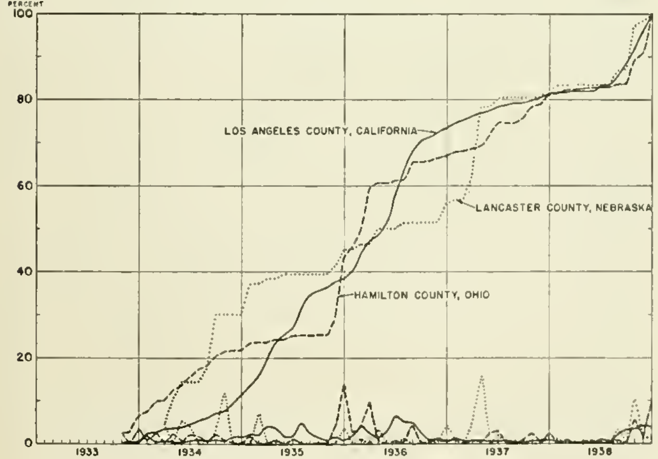
Table 12.—*Percentage of total value of all contracts awarded on PWA projects, cumulatively by months, for 3 selected counties,*[1] *1933–38*—Continued

	Los Angeles County, Calif.	Hamilton County, Ohio	Lancaster County, Nebr.
1936			
January	40.4	45.8	45.2
February	44.7	49.8	46.4
March	47.2	59.7	46.4
April	48.5	60.5	50.0
May	51.3	60.5	50.0
June	57.8	61.1	50.0
July	63.0	61.1	51.3
August	68.1	65.3	51.3
September	70.6	65.3	51.3
October	71.4	65.7	51.3
November	72.5	66.3	51.6
December	73.2	66.9	56.0
1937			
January	74.6	67.9	56.8
February	75.3	68.0	56.8
March	76.1	68.8	62.1
April	76.8	69.2	78.1
May	77.4	71.7	78.1
June	78.2	74.8	80.3
July	78.7	74.8	80.3
August	79.2	74.8	80.3
September	79.3	75.8	80.3
October	79.9	78.4	80.3
November	80.4	78.9	80.5
December	81.5	81.2	82.2
1938			
January	81.6	81.2	83.2
February	81.6	82.1	83.2
March	82.0	82.2	83.2
April	82.0	82.4	83.2
May	82.0	82.9	83.2
June	83.1	82.9	83.2
July	83.2	82.9	83.2
August	85.3	83.6	86.8
September	88.5	83.6	87.0
October	91.9	89.2	97.4
November	96.1	90.8	98.5
December	100.0	100.0	100.0

[1] Los Angeles County comprises the City of Los Angeles; Hamilton County includes the city of Cincinnati; and Lancaster County includes the city of Lincoln. Projects only partly within the counties are excluded. The dates used are those on which the contracts were given official PWA approval.

FIG. 19

PERCENTAGE OF TOTAL VALUE OF ALL CONTRACTS ON P.W.A. PROJECTS AWARDED MONTHLY AND CUMULATIVELY BY MONTHS, FOR THREE SELECTED COUNTIES.[1]



[1] LOS ANGELES COUNTY COMPRISES THE CITY OF LOS ANGELES, HAMILTON COUNTY INCLUDES THE CITY OF CINCINNATI, AND LANCASTER COUNTY INCLUDES THE CITY OF LINCOLN PROJECTS ONLY PARTLY WITHIN THE COUNTIES ARE EXCLUDED THE DATES USED ARE THOSE ON WHICH THE CONTRACTS WERE GIVEN OFFICIAL PWA APPROVAL

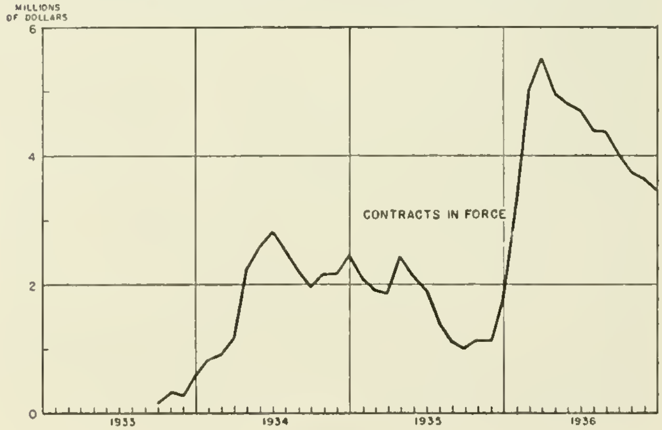
Table 13.—*Value of contracts remaining in force on non-Federal PWA projects in Maryland, 1933–36*

	Thousands of dollars
1933	
September	130
October	320
November	280
December	590
1934	
January	840
February	920
March	1,190
April	2,280
May	2,600
June	2,820
July	2,560
August	2,220
September	1,980
October	2,180
November	2,190
December	2,480
1935	
January	2,100
February	1,920
March	1,860
April	2,430
May	2,120
June	1,810
July	1,400
August	1,100
September	1,030
October	1,140
November	1,140
December	1,800
1936	
January	3,300
February	5,020
March	5,500
April	4,960
May	4,800
June	4,700
July	4,400
August	4,380
September	4,020
October	3,720
November	3,640
December	3,460

It is apparent from these figures that the contract awards in the various PWA programs in these localities have shown a tendency to be grouped within a space of relatively few months. Thus, from November 1934 to April 1935, contracts were awarded which represented 16 percent of the value of all PWA contracts in Los Angeles County from 1933–38. In the 3 months of June, July, and August 1936, 16 percent of all PWA contracts was awarded. From August to December 1938, 17 percent of all contracts was awarded. Similarly, in the Cincinnati area 14 percent of all contracts was awarded in December 1935, and 35 percent in the months November 1935 to March 1936. From October to December 1938, over 16 percent of all contracts was awarded. In

FIG. 20

VALUE OF CONTRACTS REMAINING IN FORCE ON NON-FEDERAL P.W.A. PROJECTS IN MARYLAND,[1] 1933–36



[1] THE CLASSIFICATION "VALUE OF CONTRACTS IN FORCE" EXCLUDES THE ESTIMATED VALUE OF THE WORK ALREADY COMPLETED ON PAST OR OUTSTANDING CONTRACTS

the county surrounding Lincoln, Nebr., contracts representing over 12 percent of the value of all PWA contracts were awarded in August 1934; 16 percent was awarded in April 1937, and over 10 percent in October 1938; 3 months accounted for nearly 40 percent of all contracts, in terms of dollar value. It should be noted however, that in each of the counties there was some spreading of contracts over the intervening months. The most pronounced concentration of awards occurred toward the end of 1938, as a result of the requirement that construction should be under way on all projects by January 1, 1939.

The figures with respect to Maryland non-Federal projects tell a similar story. These do not extend beyond 1936 and are in terms of the value of contracts in force,[8] rather than contract awards. During April 1934 the value of contracts in force almost doubled, increasing from around $1,190,000 to $2,280,000; and in May and June they rose by an additional $540,000. From December 1935 to March 1936, contracts in force increased almost fivefold, from $1,140,000 to $5,500,000.

Where public works projects are a dominant element in the local construction market, as they have been in many localities in recent years, this tendency toward the bunching of contract awards within short periods of time can scarcely fail to have a more pronounced and unfavorable effect on construction costs than a similar volume of contracts spaced more evenly. Contractors receive all at once a considerable number of invitations to bid on public contracts. Attempts to speed up public works projects result in hastily drawn specifications. The contractors do not have sufficient opportunity to figure closely on the basis of a careful examination of the requirements. As a result, a tendency arises to write up bids by a certain percentage to cover possible unforeseen costs resulting from inadequate preparation, and a lift is given to construction costs in the local market. Furthermore, the publicity which is attendant upon the passage of a large Federal program and the allocation of funds to a specific locality perhaps increases the optimism and anticipation of the local market, with a strengthening effect upon bid prices.

In this connection the position of the contractor's profit margin should be noted again. It is likely that this element in contract costs is the most responsive to sudden increases in activity and to changes in the psychological attitude of the local construction markets. It may well be, although there is no evidence on this point, that over the period of the last 10 or 12 years the profit margin on construction work has been, apart from cyclical influences, substantially narrowed as a result of the relatively high level of building material prices and of the rise in wage rates. Nevertheless, in specific situations, any lift that may be given to contract costs by the publicity given to Federal efforts to increase public works construction activity and by the bunching of contract awards exerts its direct and immediate influence on the extremely flexible profit margins of local contractors.

The timing of bid invitations would be of more importance than the dates of actual contract awards. Unfortunately, figures with respect to the former are not available in adequate form. However, it is likely that the invitations were somewhat more closely grouped than the contract awards, since not infrequently the original bids were thrown out, or other complications and delays arose before the contracts were officially approved.

Summary

Insofar as the volume or timing of federally financed construction affects construction costs and prices, it can be said to influence directly the level of private and unaided State and local activity. This chapter has investigated: First, the relative levels of construction costs and of other costs and prices; second, the movements in aggregate construction costs compared with movements in the volume of federally financed and other construction; third, the trend of material prices and wage rates compared with federally financed material orders and wage payments; and, fourth, the timing of PWA contract awards in specific localities.

With respect to the relative level of construction costs, it was found that the price index of the factors entering into construction costs has moved, since 1933, far above the indexes representing the cost of constructing similar projects. Prices of construction elements (the *Engineering News-Record* index) were, in 1937–38, about 13 percent above the 1926 level, whereas contract costs of similar construction (the Interstate Commerce Commission and American Appraisal Co. indexes) were an equivalent amount below. This sharp rise in construction prices was found to be due primarily to the large increase in construction wages to a level in 1937-38 substantially in excess of the predepression level, plus the extraordinary heavy weight given to the labor factor in the *Engineering News-Record* index. Consequently, the gap between construction prices and costs, presumably, has been accompanied by a substantial increase in the efficiency of construction labor, together possibly with narrower profit margins. However, while construction wage rates have followed wage rates in general, building material prices have moved substantially above other wholesale prices.

In relating the estimated quarterly volumes of federally financed and private construction to the movements in construction prices and costs, it was found that, insofar as there was any causal relationship between construction volume and costs (except in 1937), movements in the volume of federally financed construction apparently had the greatest effect. This was notably true in certain periods, such as 1933–34 and middle 1936 when rapid increases in federally financed activity were accompanied by large upward price movements, and in 1938 when the downward trend of prices was reversed at a point when only federally financed construction was rising, and when prices in general were continuing to decline.

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[8] The classification "value of contracts in force" excludes the estimated value of the work already completed on past or outstanding contracts.

An examination of combined building material prices and of certain individual prices indicated similar possibilities of the direct influence of federally financed material orders on prices in specific periods.

Average hourly earnings on regular Federal and PWA projects were found to follow prevailing construction wage rates generally; they were more frequently below than above private rates. A notable exception was the hourly earnings on the NIRA non-Federal projects, which were consistently and substantially above the prevailing level. This seems to have been due to administrative wage regulations on this program which were not repeated in the case of subsequent programs. Hourly earnings on WPA projects were, in the aggregate, at all times well below the prevailing level.

It has been stated that, unless public works construction is to be discarded as an instrument for increasing employment and business activity, its effect on costs is not open to serious criticism unless it should be greater than that of a similar increase in private construction expenditure. Increases in federally financed construction may have had such an undue price influence in recent years, and this possibility appears to arise from the timing of the programs and the conditions under which it has been necessary to carry them out. An investigation of the contracts awarded on PWA projects in four localities showed that awards tended to be bunched within short-time periods. The probable effect was to increase contract costs, particularly profit margins, rather more than a gradual and less apparent rise in private activity would have done.

CHAPTER VI—TIMING AND EMPLOYMENT FLEXIBILITY OF PUBLIC WORKS CONSTRUCTION

The Question of Timing

The discussion and analysis in the preceding chapters enable us to see rather clearly at this time the requirements of a public works program so far as timing and flexibility are concerned. At one stage in the development of a public works policy as related to employment, the questions of timing were considered to be of critical importance. The problem of unemployment and idle resources was seen largely or purely as a cyclical phenomenon; proponents of public works expenditure argued for a quick expansion of public works employment as private employment fell off and for a corresponding retraction as private employment increased. The timing of the public works program and the flexibility which made appropriate timing possible were obviously essential.

As noted in the first chapter, there has been doubt in recent years whether the problem of unemployment and low production is, in fact, a cyclical one. There is at least the possibility of a continuing low level of private investment and a continuing high level of unemployment. If public works are to be used in this situation as part of the defense against unemployment, they will be part of a continuing or long-time program.

In the second and third chapters it has been shown that, given unemployment on the scale of recent years and public works activity on a scale of two to three billion dollars' worth annually, there will still be a vast amount of play between total public works employment and total unemployment. To argue that public works activity, under such circumstances, should be adjusted upwards and downwards with all the ups and downs of private employment is somewhat like cautioning a 5-foot man against bumping his head on 50-foot rafters. Under present circumstances, or even with much expanded public works and much contracted unemployment, a big margin will exist between total public works employment and the total available labor supply, even that available for construction. This margin, it is fair to expect, will have to be cared for by methods other than public works—by Work Projects Administration, Civilian Conservation Corps, and other organizations, which are better able to deal with the problem.

Even though the idea of adjusting public works construction volume to the upper limits of unemployment were abandoned and public works expenditures were considered to have a degree of permanence as an employment policy, problems of timing would not disappear. Periods of rapidly increasing unemployment, as in the latter part of 1937, would call for more public works expenditure, assuming, of course, that public works construction were being used to combat unemployment. Should private employment, with a revival of private investment, again tend to absorb all or a high proportion of the unemployed, public works construction activity would have to be contracted. This would be necessary for the reason that at full employment, pressure on industrial capacity and labor supply might cause too rapidly advancing prices and inflation; public works expenditures are subject to control which private investment is not. Contraction of public works expenditure is one defense against this danger which arises with full employment.

To summarize, the practical problem of public works timing, under conditions as they appear at present, is not that of arranging an on-again-off-again program to accord with the appearance and disappearance of unemployment. Nor, under conditions as they now appear, can it be expected that the total volume of construction employment can be made to absorb all unemployed. Timing of public works consists in having a continuing program (possibly expanded to accord with continuing unemployment) which can be increased or decreased with the broader swings in employment and economic activity. To see whether this more moderate requirement in timing can be met in practice is the task of the remainder of this chapter. The chapter attempts to measure the minimum time required, on the basis of past experience, to expand Federal and federally-aided construction. The fact that the measurements are made does not imply that the greatest possible haste in launching public works is desirable or necessary.

So far as Federal or federally aided public works are concerned, two important aspects of flexibility are still necessary for favorable timing in the public works programs. In the first place, flexibility is needed in the authorization of, and appropriation for, increases in public works programs; and contraction should be dependent upon contracting need rather than upon completion of the expenditure of a fixed appropriation. Secondly, the programs themselves, so far as the speed with which they get under way and the employment which they provide are concerned, will have to be subject to control; more control, if possible, than at present. With respect to these the problem of flexibility with which we are concerned here is largely one of knowing in advance how different kinds of projects, and hence differently composed programs, will behave after they get under way and of planning them accordingly.

In the next section the question of legislative provision and appropriation for public works expenditure is taken up as it bears upon the flexibility of public works programs and their timing in relation to unemployment. The succeeding sections are given over to a detailed analysis of the time required to put various classes of construction under contract with different conditions, and the behavior of employment (the "labor pattern") after construction has started.

Flexibility in Authorization and Appropriation for Public Works

A Federal or federally aided public works program begins, of course, with its consideration by the Congress. The sum of money involved is large, and the question of its size is, inevitably, a matter of much public and political concern. So is the question of where and for what it is to be spent. It is a matter of experience, and a safe forecast for the future, that Congressional authorization and appropriation for public works is and will be a time-consuming matter. This would be so even assuming that the principle of using public works construction to offset unemployment were not itself a major issue.

Delay in authorization and appropriation for public works thus presents at the outset a major obstacle to closely controlled timing. This has been amply illustrated by the experience of recent years. In each year from 1933 to 1938 there was an "emergency" appropriation for public works; furthermore, the appropriations have varied in size in accordance with the unemployment situation and the general level of business activity. However, it is scarcely possible to speak of a unified program over the period. Instead, there has been a series of programs, and the launching of each program has been governed very largely by the date of Congressional approval. In practice this date has depended, not upon the trend of business activity and unemployment, but upon the exigencies of Congressional business in general and the necessarily slow progress of a controversial measure through the two Houses. In all years but one, authorization has come during the last two weeks of June. This has been followed by extreme pressure to get the programs under way quickly; particularly in 1938, this pressure came long after the business and unemployment situation had become so serious that, had public works been well timed, an expanded program would have been well under way. Appropriations in the month of June present special obstacles, as will be shown later, for it means that a considerable part of the work is put under contract too late for construction to begin before the onset of unfavorable winter weather. Of course, in the months before June 21, 1938, just as in the years before June 16, 1933, there was hesitation over the principle of launching a new works program.

Furthermore, only a part of the total public works construction of the Federal Government has been provided for by PWA appropriations. Regular Federal appropriations to departments and agencies have continued in the various supply bills. There is no reason to distinguish between the employment- and income-creating effects of these appropriations and the appropriations made available to the PWA. During 1937 and 1938[1] more men found employment on the site of regular Federal public works construction than on the Federal and non-Federal programs of the PWA. Little or no over-all thought is given to the timing or employment effect of these "regular" public works and, so long as they are scattered among a large number of supply bills, there seems to be little likelihood that such thought will be given. The answer seems quite clearly to be a greater centralization of public works appropriation procedure. In the face of these problems there have been a variety of proposals which have ranged all the way from suggestions for more expeditious procedures in passing public works appropriation bills, to proposals for blanket appropriations giving the executive large discretionary powers over the volume, timing, and character of all public works expenditure.

The first step toward a solution is a clear recognition of the new responsibilities which the use of public works construction as a stabilizing influence involves. Although we have thought of public works appropriations in this light for the past 6 years, we have followed nearly the same ideas and procedures in authorization and appropriation that we have always followed. In legislative procedures we have tackled the old question of what to build and how much and have not faced the new question of when or how promptly, which is inherent in proper timing. Only after appropriation bills have been passed has the new situation been recognized. Then in the critical years recognition has inevitably taken the simple form of a demand for all haste in making up for lost time.

As a minimum program for legislative flexibility, the public works program as a whole, for the ensuing fiscal year, might be made the first order of business upon the reassembling of the Congress each January. Since the regular Federal appropriations for public works are an integral part of the problem, three things might be determined and authorized at that time as follows:

1. The major construction programs that are now included in regular departmental appropriations, including rivers and harbors improvements and the construction programs of the War and Navy Departments.

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[1] See table 4, ch. IV.

2. The size and character of the supplementary appropriation for Federal public works, if any, for the ensuing fiscal year, this to be, as hitherto, a lump sum appropriation for administrative allotment to specific projects.

3. The size and character of the non-Federal public works program for the ensuing fiscal year.

The second item assumes the continuation of the principle of making a part of the appropriation for Federal public works in the form of a lump sum to be allotted to specific projects by executive action. Continuation of this procedure, which as an "emergency" device was an important factor in the 1933 and 1938 PWA programs, is a debatable point. It does introduce an important element of flexibility into public works procedures. The timing and regional distribution of allotments under such an appropriation could, possibly, be better adjusted to movements in economic activity and employment than regular appropriations. Also, its total volume is more likely, than in the case of regular appropriations, to be considered and adjusted in accordance with broader economic conditions. Even though appropriations under this head are normally small, the principle of a "Federal PWA" type of public works program might be continued permanently.

There are a number of other problems growing out of these proposals. Certain Federal departments and agencies with major construction operations might have, in effect, two appropriation bills: one for part or all of their construction activity and another for their regular nonconstruction appropriations. However, through the Federal 6-year program [2] there has already been considerable progress in advance determination of construction requirements. To have a major part of this program for the ensuing year considered and acted upon en bloc by the Congress is a considerable but not impossible step beyond the present 6-year program of Federal works. In the case of departments and agencies for which construction is incidental to the performance of other services, it is probably necessary to continue the present practice of considering the construction program in conjunction with other requirements as part of the regular supply bill.

The second problem is the difficulty of determining so far in advance the size of the program which will be needed. One can talk of careful business forecasting and prediction but as matters now stand this is not an answer; what can be done by way of forecasts does not carry great conviction. However, the alternative is not between acting too soon or too late. If a proposed public works program were acted upon in January or February it would always be possible to make corrections later. Appropriations that are too small could be subsequently increased, and it would be within the proper range of executive power to curtail work which proves to be in excess of need. The improvement over the present situation would be great.

Faced with what has been called here the problem of legislative inflexibility, many serious students of public works have made rather stronger proposals. The idea of advance appropriations to be held in reserve against need as determined by the Executive has been seriously discussed; so have proposals for appropriations which are contingent upon the increase of unemployment to the point where expanding works are automatically authorized.[3] The present proposals are not advanced as better than these arrangements; they are offered rather as the most moderate of the possible improvements over the present procedure.

Procedures Following Legislative Authorization

Once a program of public works is authorized by Congress and funds appropriated for it, or, in light of other procedures mentioned in the preceding section, once a decision is made to expand public works construction, a series of steps remain before employment is increased, and a further set of considerations governs the time which will elapse before the full effect appears. In the pages following, the time required for these various steps is analyzed on the basis of PWA experience in recent years.

The first step following legislative authorization is for the departments and bureaus of the Federal Government to record their applications for public works with the public works agency, i. e. the Public Works Administration. Likewise, in a non-Federal program States and localities must file applications including preliminary specifications of the work to be constructed, estimated cost, estimated labor requirements, and the like. These must be cleared through the regional offices of the PWA and filed for final action with the Washington office.

This first step may, however, come in advance of Congressional authorization of the program and, in practice, this has become partly the case with both Federal and non-Federal works. Work has been under way for some years on a 6-year program of Federal public works, which means that proposals of Federal agencies for a greater part of their public works are on record several years in advance. In other words a reservoir of Federal projects is always available. To be sure, procedures in connection with carrying out these works are not ideal; they are, in the main, part of the regular Federal building program and, as such, are appropriated for in the various departmental appropriation bills. The case for a larger degree of centralization of all Federal construction appropriations has already been discussed. However, the important thing for the present discussion is that the Federal 6-year program does make available a reservoir of public works proposals to many of which allotment of funds can be made. If construction is to be expanded, construction slated for subsequent years can be moved ahead. Allotment to specific projects can be made almost concurrently with the legislation authorizing an expanded works program. In 1938 (table 1) approximately 77 percent of the funds available for Federal construction was allotted on the 21st of June, the day on which the public works appropriation bill of that year received presidential approval.

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[2] Each Federal department and agency is required by Executive order to present annually a schedule of suggested construction for the following 6 years.

[3] See Henry S. Dennison, Lincoln Filene, Ralph E. Flanders, and Morris E. Leeds, *Toward Full Employment*, Whittelsey House 1938, pp. 1–30.

The case of federally aided, non-Federal construction is somewhat different. Applications must come in from States and localities; the preparation and review of these applications takes time. However, it is unnecessary that this function await authorization or decision to expand public works. The appropriations from 1933 on brought applications in excess of the number to which allotments could be made from funds appropriated. These applications constituted a reservoir from which projects could be drawn and allotments made immediately. Thus, it was possible in 1938 to make 900 such allotments in the 3-day period following the signing of the act. Procedure in this respect has again been far from perfect. Each public works program since 1933 has been initiated to some extent on the assumption that it would be the last. Applicants ceased to file applications after the period in which they stood a chance of getting approval had passed. If applicants were encouraged to continue to file projects against future programs, and if it were a major responsibility of the public works agency to maintain an "active file" of such projects,[4] which the applicants would be depended upon to undertake with an expanded program, there would be no problem of delay in obtaining and passing upon applications in non-Federal construction.

TABLE 1.—*Dates of allotments for Federal projects under PWAA—1938 through Aug. 15, 1938*

1938	Total amount of allotment made on each date	Cumulative percentage of all allotments
June 21[1]	$154,739,971	77.4
June 23	100,000	77.4
June 25	1,895,000	78.4
June 30	136,000	78.4
July 7	12,438,400	84.7
July 8	600,000	85.0
July 11	2,565,100	86.2
July 14	17,375,400	94.9
July 18	192,000	95.0
July 27	3,709,000	96.9
Total to Aug. 15, 1938	193,750,871	
Total of all allotments	199,999,207	

[1] Date of approval of act.

Source: Based on data submitted by Planning and Federal Projects Division, Public Works Administration.

The maintenance of such a file of non-Federal public works applications would appear to be a worthwhile step in the development of a permanent public works program. It does involve certain problems, however. It is an open question whether any applications would be filed when there was comparatively little chance of obtaining funds. A continuing program of some minimum size appears to be a prerequisite to having such a reservoir of projects. There is also the possibility that some municipalities might delay their construction programs in the hope of getting Federal assistance, and that applications would come most freely from those communities which are unable to finance construction themselves. In some cases special aid to such communities is doubtless desirable. A permanent program, however, cannot discriminate against the well-managed, strongly financed unit.

Between the time that an application for a project allotment is approved and the start of construction and peak employment, there is a further series of steps. Between allotment and awarding of contracts, it is necessary to complete architects' drawings, prepare bid specifications, advertise for and receive bids, and finally award the contracts. In addition, in non-Federal construction the PWA must submit its offer of a grant or loan to the applicant, enter into a financial contract with the State and locality, and approve the final plans and contract award. Ordinarily, it is necessary for the State or locality to complete plans for financing its share of the cost, and frequently it must hold an election to approve a bond issue. After the contract is awarded there is a further period before work starts on the site and construction actually gets under way. Once construction is under way, a variety of factors bear upon the speed with which construction moves and employment is provided.

It has been possible to analyze in some detail the experience of the PWA in these three steps: (1) Allotment to contract award; (2) Contract award to start of construction; and (3) Rate of construction progress and employment. The rest of the chapter is given over to this analysis. If, as has been stated,[5] the significant phase of the problem of flexibility in public works is the problem of knowing what will be the behavior of different types of programs, then the factors governing the length of time it takes to prepare contracts, and those determining the rate of progress after awarding of contracts, are highly relevant.

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[4] Once applications are made by States and localities a variety of reasons may lead them to withdraw the application. Construction may be undertaken by the applicant without a grant, may be done under WPA, or the applicant may simply decide not to proceed with the project.

[5] See pp. 74, 75.

Time From Allotment to Contract Award

The non-Federal PWA programs present the most serious problem of an uncontrollable lapse of time between the authorization of an allotment and the awarding of contracts. Several problems arise, including negotiation between Washington and the States and localities, the necessity for some measure of Federal supervision over the preparation of plans and the awarding of contracts, the special problems of State and local finance, the holding of bond elections, and the technical engineering and architectural work which must precede actual construction.

In the case of Federal projects, many of the above matters do not arise at all. A Federal department which receives a PWA grant for a new building may be able to proceed at once with preparation of plans and bid specifications, and some of this work may actually have been done in advance of allotment. A State or locality, uncertain whether it will receive an allotment until it is actually made, can hardly be expected to spend much money in preparation for contracts which may never be awarded. In a continuing program, as distinct from a series of "emergency" programs, some of these steps might be taken in anticipation of funds that would be available, if not at the moment, then certainly sometime in the future. However, a considerable volume of detail must always remain for the period immediately preceding the awarding of contracts.

A study has been made of the elapsed time between the date of allotment and the awarding of the first contract for different kinds and sizes of projects under the 1933 and 1938 non-Federal programs.[6] Taking the total number of projects in each program as equalling 100 percent, the proportion of the total under contract, in different numbers of elapsed days after the date of allotment, has been calculated.[7] Cumulative percentages of the total number of contracts awarded by elapsed days after the date of allotment are shown in table 1. A total of 3,319 projects are included in the 1933 program and a slightly larger number, 3,799, in the 1938 program.

It is clear, first of all, that there was a striking difference between the 1933 and 1938 programs. As indicated by figure 1, on about 90 percent of all of those projects in the 1938 program included here, contracts had been awarded within 100 days from the date of allotment. In the 1933 program it was over 350 days before 90 percent of the contracts had been awarded. In neither program had an appreciable proportion of the contracts been awarded within 50 days of the date of their allotment, but in the next 50 days the contrast becomes marked. Within 75 days after allotment in the 1933 program, less than 20 percent of the contracts had been awarded. In 1938 within the same period 65 percent had been awarded.

The short deadlines set by the 1938 act— all projects to be started by the end of the year—were undoubtedly a factor in the foreshortening of the allotment-to-contract-award period. However, the existence of an organization for administering public works with established procedures and experience and the availability of project applications were unquestionably more important factors. The simplification of legal procedures for dealing with States and localities was also a factor. The possibility of a further shortening of this period is, of course, something which cannot be stated with confidence. The evidence from the two programs would indicate that few projects can be placed under contract in less than 50 days.[8] Since the 1938 experience demonstrates the possibility of having contracts awarded for substantially all of a program within 100 days, it does seem safe to conclude that the allotment-to-contract-award period for non-Federal construction, even allowing for some further shortening of administrative procedures, will be from 2 to 3 months.

Types and Sizes of Projects

There is no clear evidence that the kind of construction bears strongly upon the time necessary to award contracts on projects. In figures 2 and 3 the proportion of all projects awarded after different elapsed periods from the allotment date are shown by kind of construction. In the 1933 program (fig. 2), it will be observed, flood control, water power projects, and the like, lagged far behind the others, while in the 1938 program (fig. 3) contracts were awarded more promptly on these than on any other class of construction. In this case the number of projects happens to be small, and litigation, disputes with affected parties, and the like, may account for considerable chance variation. Contracts for streets and highways in both programs were awarded more rapidly than for most other classes of construction, and buildings tended, particularly in 1938, to lag somewhat. However, the range of the difference, particularly in 1938 which is undoubtedly the most valid guide to the future, is small. Excluding flood control and water power projects, only 10 to 15 days separate the class of projects going under contract award most rapidly from a similar stage of progress for those which take longest.

The effect of the size of the projects on the allotment-to-contract-award time is more certain, although it is not great. Some care is necessary in the analysis here, for the question is not whether a small project can be put under contract more quickly than a large one. The question is whether a large number of small projects can be put under contract award as rapidly or more rapidly than a smaller number of large projects. This is the form in which the question presents itself in planning the disposition of a public-works program of a given size.

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[6] The basic tabulations for this study were made by the Projects and Statistics Division of the Public Works Administration.

[7] In the 1938 program, projects which were approved and pending, i. e., in the reservoir, at the time of the passage of the act were excluded. Because of the need for determining in certain cases whether the application was still active, the time between allotments and award of contracts was somewhat increased. Such checking up should not be necessary with a continuing program.

[8] In its very early stages the 1938 program actually lagged slightly behind the 1933 program.

To analyze the problem, the 1933 and 1938 programs have been divided into two parts. Projects costing less than $100,000 have been termed small projects; those costing $100,000 or more have been classed as large projects. For most classes of construction, projects costing less than $100,000 are substantially more numerous than those costing in excess of this amount. In tables 2 to 8 and figures 4 to 7, the rate at which small projects went under contract award is compared with the rate for large projects for the two programs and for several classes of construction. In the 1933 program it took substantially longer to get the large projects going than the smaller ones. There were, for example, 253 street and highway projects costing less than $100,000 and 131 costing more than this amount. After 150 days from allotment 65 percent of the smaller projects was under contract award, and when the same time elapsed only 44 percent of the larger projects was similarly advanced. A detailed analysis indicates that the greatest lag occurred in projects of between $100,000 and $500,000 cost; these, of which there were 105, were only 39 percent under contract award after 150 days from allotment. In the case of buildings, 730 small projects went under contract at a substantially more rapid rate than 446 large ones. A similar situation held for other classes of construction, although it is to be noted that in the case of engineering structures the projects costing less than $100,000 were less numerous than those costing more than this amount.

In 1938 the effect of size was less noticeable. There were 223 street and highway projects of less than $100,000 and 166 costing in excess of this amount. At the end of 2 months from allotment almost exactly the same proportion of the two programs was under contract award. Slightly more rapid progress was made with the small projects in the case of other kinds of construction, but the difference was not marked. The 1938 Appropriation Act required that no project receive an allotment which, "in the determination of the Administrator," could not be started by the end of the year. The effect of this was to eliminate certain of the more complex and, in all probability, more costly projects. Allowing for this, however, it seems doubtful if size is a major factor in determining the length of the allotment-to-contract-award period.

So far as the non-Federal program is concerned the situation is this: assuming that a reservoir of "active" projects is available, it should be possible in light of experience to have a program, or an increase in a program, substantially under contract within from 2 months as a minimum to 3 months as a maximum after authorization. This is the "uncontrollable" delay in expanding a non-Federal program in the allotment-to-contract-award stage with present procedures. Apparently the kind of construction undertaken makes little difference in the length of this period. If the program is composed of many small projects, as compared with fewer large ones, the period will be cut down, but at most by only a few days.

No detailed analysis has been made of the allotment-to-contract-award period for Federal construction. However, it is clear that for this type of construction

PERCENTAGE OF TOTAL PROJECTS WITH CONTRACTS AWARDED IN DIFFERENT PERIODS OF ELAPSED TIME AFTER AUTHORIZATION OF ALLOTMENT

FIG 1 N I R A AND P W A A NON-FEDERAL PROGRAMS

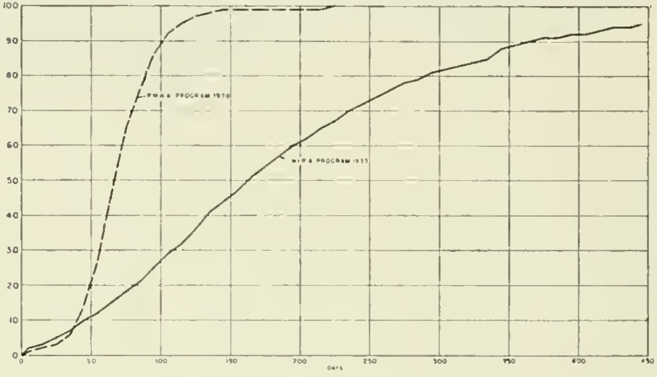


FIG 2 N I R A NON-FEDERAL PROGRAM

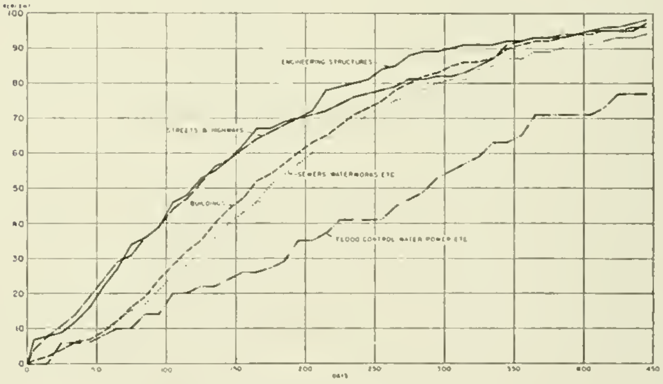
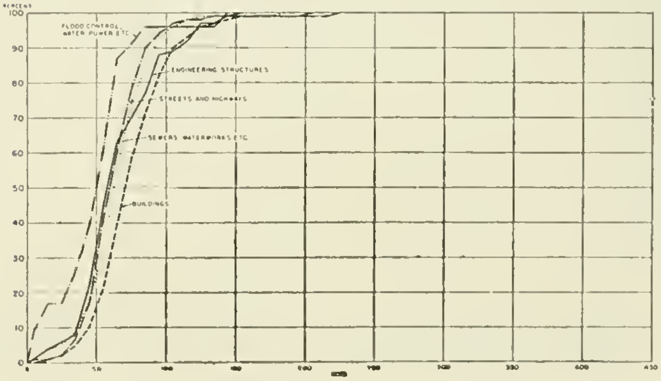


FIG 3 P W A A NON-FEDERAL PROGRAM



the minimum period is considerably less than for non-Federal construction. The administrative procedures are considerably simplified; after approval of the allotment and clearance of a transfer of funds through the office of the Comptroller General, no further administrative routine remains. It is possible to proceed at once with the preparation of plans and specifications and completion of architectural and engineering details preparatory to the awarding of contracts. In a few cases departments and bureaus with established experience, and with construction programs of a more or less routine sort, may even have completed some of these details in advance. The result has been a shorter allotment-to-contract-award period in the case of Federal than in the case of non-Federal construction. If, once more, the 1938 program is taken as the best indication of what can be expected in the future, it should be possible to have an enlarged program of Federal construction substantially under contract award within 6 weeks, and possibly even a month, from the date of allotment. As shown in table 1 above, about 77 percent of the 1938 Federal program of $199,999,207 was allotted on the day that the public-works appropriation act of that year became law. By July

Table 2.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size [1] and type*

BUILDINGS

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0–10	9	1	4	1	13	1	5	0	4	1	9	0
11–20	6	2	5	2	11	2	15	1	9	2	24	1
21–30	14	4	4	3	18	4	12	2	10	3	22	2
31–40	18	6	7	4	25	6	34	4	13	5	47	5
41–50	10	8	7	6	17	7	98	11	31	9	129	10
51–60	17	10	8	8	25	9	180	23	58	17	238	21
61–70	26	14	12	11	38	12	320	45	107	31	427	40
71–80	30	18	12	13	42	16	260	63	130	49	390	58
81–90	22	21	12	16	34	19	169	74	106	63	275	71
91–100	39	26	19	20	58	24	144	84	108	77	252	82
101–110	40	32	14	23	54	28	106	91	72	87	178	90
111–120	21	35	22	28	43	32	41	94	39	92	80	93
121–130	26	38	11	31	37	35	32	96	17	95	49	96
131–140	36	43	24	36	60	40	29	98	15	97	44	97
141–150	34	48	13	39	47	44	7	99	7	98	14	98
151–160	26	51	5	40	31	47	8	99	12	99	20	99
161–170	33	56	22	45	55	52	4	100	2	99	6	99
171–180	12	57	14	48	26	54	2	100	1	99	3	99
181–190	19	60	22	53	41	57	2	100	0	99	2	99
191–200	21	63	11	56	32	60	1	100	1	99	2	99
201–210	16	65	16	59	32	63	1	100	2	100	3	100
211–220	17	67	14	62	31	65	------	------	------	------	------	------
221–230	14	69	16	66	30	68	------	------	------	------	------	------
231–240	21	72	12	69	33	71	------	------	------	------	------	------
241–250	15	74	13	72	28	73	------	------	------	------	------	------
251–260	16	76	9	74	25	75	------	------	------	------	------	------
261–270	18	79	10	76	28	78	------	------	------	------	------	------
271–280	20	82	10	78	30	80	------	------	------	------	------	------
281–290	11	83	7	80	18	82	------	------	------	------	------	------
291–300	8	84	4	80	12	83	------	------	------	------	------	------
301–310	11	86	10	83	21	85	------	------	------	------	------	------
311–320	6	87	8	85	14	86	------	------	------	------	------	------
321–330	4	87	3	85	7	86	------	------	------	------	------	------
331–340	7	88	4	86	11	87	------	------	------	------	------	------
341–350	14	90	13	89	27	90	------	------	------	------	------	------
351–360	6	91	4	90	10	91	------	------	------	------	------	------
361–370	9	92	3	91	12	92	------	------	------	------	------	------
371–380	7	93	4	91	11	92	------	------	------	------	------	------
381–390	4	94	3	92	7	93	------	------	------	------	------	------
391–400	7	95	2	93	9	94	------	------	------	------	------	------
401–410	4	95	1	93	5	94	------	------	------	------	------	------
411–420	3	95	1	93	4	95	------	------	------	------	------	------
421–430	1	96	3	94	4	95	------	------	------	------	------	------
431–440	3	96	3	94	6	96	------	------	------	------	------	------
441–450	3	96	4	95	7	96	------	------	------	------	------	------
Over 450	26	100	21	100	47	100	------	------	------	------	------	------
Total	730	------	446	------	1,176	------	1,470	------	744	------	2,214	------

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

15 allotments had been made to the amount of about $190 million or 95 percent of the total. A month later or on August 15 contracts had been awarded or force account work started on projects on which allotments had been made in the amount of $152,299,000. In other words, 55 days after the approval of the law 76 percent of the program was under contract or force account work had started, and a month after allotments were 95 percent complete, contracts had been awarded or force account work had begun on the equivalent 80 percent of this construction.

There would appear to be a possibility of further slightly shortening this period for Federal works. As noted above, State and local units of government can hardly be expected to prepare plans and specifications and be ready to let contracts on public works for which they cannot be sure of getting an allotment. A program of long-range State and local cooperation with

TABLE 3.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size*[1] *and type*

STREETS AND HIGHWAYS

Number of days	1933 program (NIRA)						1935 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0-10	10	4	7	5	17	4	2	1	0	0	2	1
11-20	9	8	4	8	13	8	1	1	2	1	3	1
21-30	11	12	3	11	14	11	3	3	1	2	4	2
31-40	6	14	4	14	10	14	13	9	5	5	18	7
41-50	17	21	3	16	20	19	25	20	14	13	39	17
51-60	14	26	6	21	20	24	36	40	46	41	92	41
61-70	12	31	4	24	16	29	45	61	31	60	76	60
71-80	8	34	3	26	11	31	42	79	27	76	69	78
81-90	13	40	4	29	17	36	27	91	19	87	46	90
91-100	7	42	5	33	12	39	9	96	9	93	18	94
101-110	14	48	4	36	18	44	8	99	1	93	9	97
111-120	13	53	1	37	14	47	0	99	4	96	4	98
121-130	15	59	2	38	17	52	0	99	3	98	3	98
131-140	12	64	6	43	18	56	2	100	1	98	3	99
141-150	4	65	1	44	5	58			1	99	1	99
151-160	12	70	0	44	12	61			1	99	1	99
161-170	6	72	6	48	12	64			0	99	0	99
171-180	3	74	4	51	7	66			0	99	0	99
181-190	6	76	3	53	9	68			0	99	0	99
191-200	5	78	1	54	6	70			0	99	0	99
201-210	2	79	2	56	4	71			0	99	0	99
211-220	2	79	0	56	2	72			0	99	0	99
221-230	4	81	6	60	10	74			1	100	1	100
231-240	5	83	3	63	8	76						
241-250	5	85	1	63	6	77						
251-260	1	85	2	65	3	78						
261-270	1	86	2	66	3	79						
271-280	4	87	4	69	8	81						
281-290	1	88	0	69	1	81						
291-300	2	89	0	69	2	82						
301-310	0	89	0	69	0	82						
311-320	0	89	5	73	5	83						
321-330	2	89	3	76	5	85						
331-340	2	90	7	81	9	87						
341-350	13	95	4	84	17	91						
351-360	3	96	1	85	4	92						
361-370	1	97	2	86	3	93						
371-380	0	97	1	87	1	93						
381-390	0	97	1	88	1	94						
391-400	0	97	2	89	2	94						
401-410	0	97	3	92	3	95						
411-420	1	97	1	92	2	96						
421-430	1	98	2	94	3	96						
431-440	0	98	2	95	2	97						
441-450	0	98	3	98	3	98						
Over 450	6	100	3	100	9	100						
Total	253		131		384		223		166		389	

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

the Federal Government which would make this possible does not seem likely in the immediate future. There is no reason, however, why Federal departments and bureaus could not, in connection with the 6-year program of Federal works, actually prepare detailed plans for the works included in the plan which comes in the early years. Appropriation of funds for this purpose would be highly desirable.

It is now possible under the Federal program to make allotments approximately on the date of authorization of a program, and the 1938 experience indicates that it is possible to have the authorized increase substantially under contract within 6 weeks. If provision were made for advance preparation of plans and specifications there would be no practical reason why a substantial part of an increased Federal program could not be put under contract award within a fortnight to a month after the decision to expand the program. Under such circumstances virtually no problem of an uncontrollable delay would exist between legislative authorization and beginning of work on a program of Federal construction.

Table 4.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size* [1] *and type*

SEWERS, WATER WORKS, POWER, ETC.

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0-10	12	1	3	1	15	1	2	0	7	2	9	1
11-20	11	2	4	2	15	2	17	3	10	5	27	4
21-30	23	4	11	4	34	4	7	4	4	6	11	5
31-40	26	7	6	6	32	6	24	8	13	10	37	9
41-50	33	10	5	7	38	9	63	18	23	17	86	18
51-60	16	11	7	8	23	10	99	34	42	30	141	32
61-70	26	13	8	10	34	12	160	59	70	52	230	56
71-80	24	16	13	13	37	16	112	76	57	69	169	74
81-90	28	18	11	16	39	17	54	85	45	83	99	84
91-100	44	22	16	20	60	21	54	94	29	91	83	93
101-110	42	26	13	23	55	25	20	97	15	96	35	96
111-120	40	29	13	26	53	28	11	98	6	98	17	98
121-130	42	33	12	29	54	32	4	99	3	99	7	99
131-140	51	38	15	32	66	36	3	100	0	99	3	99
141-150	50	42	14	36	64	40	1	100	1	99	2	99
151-160	34	46	14	39	48	43	0	100	3	100	3	99
161-170	36	49	14	42	50	46	1	100	---------	---------	1	99
171-180	38	52	22	47	60	51	0	100	---------	---------	0	99
181-190	35	55	14	51	49	54	1	100	---------	---------	1	100
191-200	38	59	13	54	51	57	---------	---------	---------	---------	---------	---------
201-210	35	62	18	58	53	60	---------	---------	---------	---------	---------	---------
211-220	41	66	13	61	54	64	---------	---------	---------	---------	---------	---------
221-230	15	67	12	64	27	66	---------	---------	---------	---------	---------	---------
231-240	25	69	7	66	32	68	---------	---------	---------	---------	---------	---------
241-250	24	72	9	68	33	71	---------	---------	---------	---------	---------	---------
251-260	26	74	10	70	36	73	---------	---------	---------	---------	---------	---------
261-270	22	76	7	72	29	75	---------	---------	---------	---------	---------	---------
271-280	21	78	6	73	27	76	---------	---------	---------	---------	---------	---------
281-290	17	79	9	75	26	78	---------	---------	---------	---------	---------	---------
291-300	15	81	10	78	25	80	---------	---------	---------	---------	---------	---------
301-310	19	82	6	79	25	82	---------	---------	---------	---------	---------	---------
311-320	11	83	3	80	14	82	---------	---------	---------	---------	---------	---------
321-330	12	85	6	81	18	84	---------	---------	---------	---------	---------	---------
331-340	8	85	6	83	14	85	---------	---------	---------	---------	---------	---------
341-350	26	88	4	83	30	87	---------	---------	---------	---------	---------	---------
351-360	6	88	7	85	13	87	---------	---------	---------	---------	---------	---------
361-370	13	89	4	86	17	89	---------	---------	---------	---------	---------	---------
371-380	9	90	6	87	15	89	---------	---------	---------	---------	---------	---------
381-390	10	91	3	88	13	90	---------	---------	---------	---------	---------	---------
391-400	6	92	2	89	8	91	---------	---------	---------	---------	---------	---------
401-410	5	92	4	90	8	91	---------	---------	---------	---------	---------	---------
411-420	8	93	1	90	9	92	---------	---------	---------	---------	---------	---------
421-430	7	93	2	90	9	93	---------	---------	---------	---------	---------	---------
431-440	5	94	2	91	7	93	---------	---------	---------	---------	---------	---------
441-450	4	94	5	92	9	94	---------	---------	---------	---------	---------	---------
Over 450	63	100	34	100	97	100	---------	---------	---------	---------	---------	---------
Total	1,102	---------	424	---------	1,526	---------	633	---------	328	---------	961	---------

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

The Period From Awarding of Contracts to Beginning of Construction

Once contracts are awarded for public construction, control over the program to some extent passes from public hands into the hands of the private contractor. However, the social significance of the time which is involved is by no means lessened; the problem of flexibility in public works concerns equally the post-contract and the prior-to-contract period. Experience with the programs to date indicates that once the contracts are awarded there is a substantial lapse of time before construction actually begins. It has been possible to analyze this period for a sample of 229 projects (tables 9 and 10) drawn from all classes and sizes of Federal and non-Federal construction and from all of the programs since 1933.[9]

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[9] Power plant construction, where litigation has been a factor in delaying the beginning of construction, has been excluded as a class.

TABLE 5.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size* [1] *and type*

FLOOD CONTROL, WATER POWER, NAVIGATION AIDS, ETC.

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0-10	0	0	0	0	0	0	0	0	2	13	2	9
11-20	0	0	0	0	0	0	1	12	1	20	2	17
21-30	1	8	2	5	3	6	0	12	0	20	0	17
31-40	0	8	0	5	0	6	0	12	2	33	2	26
41-50	0	8	0	5	0	6	0	12	3	53	3	39
51-60	0	8	1	8	1	8	2	38	3	73	5	61
61-70	0	8	1	10	1	10	3	75	3	93	6	87
71-80	0	8	0	10	0	10	1	88	0	93	1	91
81-90	1	17	1	13	2	14	0	88	1	100	1	96
91-100	0	17	0	13	0	14	0	88	---------	---------	0	96
101-110	0	17	3	21	3	20	0	88	---------	---------	0	96
111-120	0	17	0	21	0	20	0	88	---------	---------	0	96
121-130	0	17	1	23	1	22	0	88	---------	---------	0	96
131-140	0	17	0	23	0	22	0	88	---------	---------	0	96
141-150	1	25	0	23	1	24	1	100	---------	---------	1	100
151-160	0	25	1	26	1	26	---------	---------	---------	---------	---------	---------
161-170	0	25	0	26	0	26	---------	---------	---------	---------	---------	---------
171-180	0	25	1	28	1	27	---------	---------	---------	---------	---------	---------
181-190	1	33	0	28	1	29	---------	---------	---------	---------	---------	---------
191-200	1	42	2	33	3	35	---------	---------	---------	---------	---------	---------
201-210	0	42	0	33	0	35	---------	---------	---------	---------	---------	---------
211-220	0	42	1	36	1	37	---------	---------	---------	---------	---------	---------
221-230	0	42	2	41	2	41	---------	---------	---------	---------	---------	---------
231-240	0	42	0	41	0	41	---------	---------	---------	---------	---------	---------
241-250	0	42	0	41	0	41	---------	---------	---------	---------	---------	---------
251-260	0	42	0	41	0	41	---------	---------	---------	---------	---------	---------
261-270	0	42	2	46	2	45	---------	---------	---------	---------	---------	---------
271-280	0	42	1	49	1	47	---------	---------	---------	---------	---------	---------
281-290	1	50	0	49	1	49	---------	---------	---------	---------	---------	---------
291-300	0	50	2	54	2	53	---------	---------	---------	---------	---------	---------
301-310	1	58	0	54	1	55	---------	---------	---------	---------	---------	---------
311-320	0	58	1	56	1	57	---------	---------	---------	---------	---------	---------
321-330	0	58	1	59	1	59	---------	---------	---------	---------	---------	---------
331-340	1	67	1	62	2	63	---------	---------	---------	---------	---------	---------
341-350	0	67	0	62	0	63	---------	---------	---------	---------	---------	---------
351-360	1	75	0	62	1	65	---------	---------	---------	---------	---------	---------
361-370	0	75	3	69	3	71	---------	---------	---------	---------	---------	---------
371-380	0	75	0	69	0	71	---------	---------	---------	---------	---------	---------
381-390	0	75	0	69	0	71	---------	---------	---------	---------	---------	---------
391-400	0	75	0	69	0	71	---------	---------	---------	---------	---------	---------
401-410	0	75	0	69	0	71	---------	---------	---------	---------	---------	---------
411-420	0	75	1	72	1	73	---------	---------	---------	---------	---------	---------
421-430	2	92	0	72	2	77	---------	---------	---------	---------	---------	---------
431-440	0	92	0	72	0	77	---------	---------	---------	---------	---------	---------
441-450	0	92	0	72	0	77	---------	---------	---------	---------	---------	---------
Over 450	1	100	11	100	12	100	---------	---------	---------	---------	---------	---------
Total	12	---------	39	---------	51	---------	8	---------	15	---------	23	---------

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

The range of elapsed time between the awarding of the first contract on a project and actual beginning of work for the sample investigated varied from a minimum of 2 days to a maximum of 225. The average for the whole sample was 48 days.

Delay occurs between the award of contract and the actual execution of the contract agreement. Within this period bonds must be posted and other formalities disposed of. After the contract is let, the most important factor determining the length of this period between contract award and start of construction is the time of the year when contracts are awarded. Within the sample studied, 150 projects had contracts awarded in the months of November to February, inclusive, and the average time to start of construction for these projects was 57 days. This compares with 30 days, or a little over half as long, for 79 projects where contracts were let in the months of March to October, inclusive. Even more significant are the percentage figures (table 10). After 60 days, construction had started on only 61.3

TABLE 6.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size [1] and type*

ENGINEERING STRUCTURES

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0–10	4	7	5	8	9	7	1	1	0	0	1	1
11–20	0	7	1	9	1	8	0	1	3	7	3	4
21–30	1	9	0	9	1	9	2	5	0	7	2	6
31–40	2	12	1	11	3	12	2	9	0	7	2	8
41–50	2	16	3	16	5	16	12	31	2	11	14	22
51–60	7	28	1	17	8	22	14	56	9	31	23	45
61–70	3	33	3	22	6	27	8	71	10	53	18	63
71–80	2	36	7	33	9	34	3	76	4	62	7	70
81–90	1	38	1	34	2	36	6	87	1	64	7	77
91–100	2	41	2	38	4	39	4	95	7	80	11	88
101–110	6	52	2	41	8	46	0	95	1	82	1	89
111–120	1	53	1	42	2	48	1	96	2	87	3	92
121–130	3	59	4	48	7	53	1	98	4	96	5	97
131–140	1	60	1	50	2	55	0	98	0	96	0	97
141–150	1	62	3	55	4	58	1	100	1	98	2	99
151–160	2	66	3	59	5	62			1	100	1	100
161–170	3	71	3	64	6	67						
171–180	0	71	0	64	0	67						
181–190	1	72	1	66	2	69						
191–200	0	72	2	69	2	70						
201–210	0	72	2	72	2	72						
211–220	5	81	2	75	7	78						
221–230	0	81	1	77	1	79						
231–240	2	84	0	77	2	80						
241–250	0	84	1	78	1	81						
251–260	2	88	2	81	4	84						
261–270	0	88	1	83	1	85						
271–280	0	88	3	88	3	88						
281–290	0	88	1	89	1	89						
291–300	1	90	0	89	1	89						
301–310	0	90	1	91	1	90						
311–320	0	90	1	92	1	91						
321–330	0	90	0	92	0	91						
331–340	0	90	0	92	0	91						
341–350	1	91	0	92	1	92						
351–360	0	91	0	92	0	92						
361–370	1	93	0	92	1	93						
371–380	1	95	0	92	1	93						
381–390	0	95	0	92	0	93						
391–400	1	97	0	92	1	94						
401–410	0	97	1	94	1	95						
411–420	0	97	0	94	0	95						
421–430	0	97	0	94	0	95						
431–440	0	97	0	94	0	95						
441–450	1	98	1	95	2	97						
Over 450	1	100	3	100	4	100						
Total	58		64		122		55		45		100	

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Engineering structures include the following: Bridges, viaducts, wharves, piers, subways, tunnels, memorial shrines, and monuments.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

percent of the projects for which contracts were awarded in the winter months. After the same time had elapsed, construction had started on approximately 90 percent of the projects for which contracts were awarded from March through October. Delay during the winter months occurs in the southern States as well as in the northern, and for the sample examined it was only slightly less important. The average delay between contract award and start of construction was only a matter of a few days less in the winter months in the South than in the same months in the North.

The sample does not permit final conclusions as to the variation between different kinds of construction in elapsed time before beginning work, although the variation is apparently considerable. For buildings the elapsed time averaged between 38 and 45 days with a comparatively small difference between winter and summer. For sewer construction the average elapsed

TABLE 7.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size [1] and type*

MISCELLANEOUS

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0–10	1	2	1	5	2	3	0	0	0	0	0	0
11–20	0	2	0	5	0	3	3	3	0	0	3	3
21–30	0	2	0	5	0	3	1	4	0	0	1	4
31–40	0	2	0	5	0	3	5	10	2	9	7	10
41–50	3	10	0	5	3	8	6	17	1	14	7	16
51–60	0	10	0	5	0	8	13	31	3	27	16	30
61–70	5	22	0	5	5	17	20	53	1	32	21	49
71–80	0	22	1	10	1	18	17	72	2	41	19	66
81–90	4	32	0	10	4	25	10	83	2	50	12	77
91–100	2	37	1	16	3	30	8	92	5	73	13	88
101–110	0	37	1	21	1	32	3	95	2	82	5	93
111–120	0	37	0	21	0	32	2	98	2	91	4	96
121–130	0	37	1	26	1	33	1	99	1	95	2	98
131–140	0	37	1	32	1	35	1	100	1	100	2	100
141–150	0	37	1	37	1	37						
151–160	1	39	0	37	1	38						
161–170	1	41	1	42	2	42						
171–180	0	41	0	42	0	42						
181–190	1	44	0	42	1	43						
191–200	2	49	0	42	2	47						
201–210	2	54	0	42	2	50						
211–220	3	61	0	42	3	55						
221–230	2	66	0	42	2	58						
231–240	0	66	0	42	0	58						
241–250	0	66	2	53	2	62						
251–260	1	68	0	53	1	63						
261–270	1	71	0	53	1	65						
271–280	1	73	0	53	1	67						
281–290	0	73	0	53	0	67						
291–300	0	73	1	58	1	68						
301–310	0	73	0	58	0	68						
311–320	0	73	0	58	0	68						
321–330	2	78	1	63	3	73						
331–340	0	78	0	63	0	73						
341–350	3	85	0	63	3	78						
351–360	0	85	0	63	0	78						
361–370	0	85	0	63	0	78						
371–380	0	85	0	63	0	78						
381–390	0	85	0	63	0	78						
391–400	0	85	3	79	3	83						
401–410	0	85	0	79	0	83						
411–420	2	90	1	84	3	88						
421–430	0	90	1	89	1	90						
431–440	0	90	0	89	0	90						
441–450	0	90	0	89	0	90						
Over 450	4	100	2	100	6	100						
Total	41		19		60		90		22		112	

[1] Small projects, contracts from $0 to $99,999. Large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

time was about 2 months, and again there was no significant difference between the winter and summer months. Highway construction, on the other hand, is strongly affected by the season in which contracts are awarded. A total of 27 projects upon which contracts were awarded in the winter showed an average elapsed time of 71 days before construction began while 19 projects placed under contract during March to October showed an elapsed time of 24 days. Although the present sample is small, the range on city street work was even greater on the sample studied: 108 days elapsed on the average for 8 projects put under contract in the winter as compared with 20 days for 2 projects in other months.

There is no evidence from the sample studied that large projects show a greater elapsed time between awarding of contract and beginning of construction than small ones, or vice versa.

The importance of the season in which contracts are awarded suggests one of the controllable elements in the period of time between the contract award and beginning of construction. If there is need to shorten this period, the bulk of the contracts should be awarded

TABLE 8.—*Frequency distribution of NIRA and PWAA non-Federal projects showing elapsed time between date of allotment and award of first contract, by size [1] and type*

ALL PROJECTS

Number of days	1933 program (NIRA)						1938 program (PWAA)					
	Small projects		Large projects		Total		Small projects		Large projects		Total	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0–10	36	2	20	2	56	2	10	0	13	1	23	1
11–20	26	3	14	3	40	3	37	2	25	3	62	2
21–30	50	5	20	5	70	5	25	3	15	4	40	3
31–40	52	7	18	6	70	7	78	6	35	7	113	6
41–50	65	10	18	8	83	10	204	14	74	12	278	14
51–60	52	13	25	10	77	12	354	29	161	24	515	27
61–70	72	16	28	13	100	15	556	51	222	41	778	47
71–80	64	19	36	16	100	18	435	68	220	58	655	65
81–90	69	22	29	18	98	21	266	79	174	71	440	76
91–100	94	26	43	22	137	25	219	88	158	83	377	86
101–110	102	31	37	26	139	29	137	94	91	90	228	92
111–120	75	34	37	29	112	32	55	96	53	94	108	95
121–130	86	38	31	32	117	36	38	97	28	96	66	97
131–140	100	43	47	36	147	41	35	99	17	97	52	98
141–150	90	47	32	39	122	44	10	99	10	98	20	99
151–160	75	50	23	41	98	47	8	99	17	99	25	99
161–170	79	54	46	45	125	51	5	100	2	100	7	99
171–180	53	56	41	48	94	54	2	100	1	100	3	99
181–190	63	59	40	52	103	57	3	100	0	100	3	99
191–200	67	62	29	55	96	60	1	100	1	100	2	99
201–210	55	65	38	58	93	62	1	100	2	100	3	99
211–220	68	68	30	61	98	65	---	---	0	100	0	99
221–230	35	70	37	64	72	67	---	---	1	100	1	100
231–240	53	72	22	66	75	70	---	---	---	---	---	---
241–250	44	74	26	68	70	72	---	---	---	---	---	---
251–260	46	76	23	70	69	74	---	---	---	---	---	---
261–270	42	78	22	72	64	76	---	---	---	---	---	---
271–280	46	80	24	74	70	78	---	---	---	---	---	---
281–290	30	81	17	76	47	79	---	---	---	---	---	---
291–300	26	83	17	77	43	81	---	---	---	---	---	---
301–310	31	84	17	79	48	82	---	---	---	---	---	---
311–320	17	85	18	80	35	83	---	---	---	---	---	---
321–330	20	86	14	82	34	84	---	---	---	---	---	---
331–340	18	87	18	83	36	85	---	---	---	---	---	---
341–350	57	89	21	85	78	88	---	---	---	---	---	---
351–360	16	90	12	86	28	89	---	---	---	---	---	---
361–370	24	91	12	87	36	90	---	---	---	---	---	---
371–380	17	92	11	88	28	91	---	---	---	---	---	---
381–390	14	92	7	89	21	91	---	---	---	---	---	---
391–400	14	93	9	90	23	92	---	---	---	---	---	---
401–410	9	93	9	90	18	92	---	---	---	---	---	---
411–420	14	94	5	91	19	93	---	---	---	---	---	---
421–430	11	95	8	92	19	94	---	---	---	---	---	---
431–440	8	95	7	92	15	94	---	---	---	---	---	---
441–450	8	95	13	93	21	95	---	---	---	---	---	---
Over 450	101	100	74	100	175	100	---	---	---	---	---	---
Total	2, 194	---	1, 125	---	3, 319	---	2, 479	---	1, 320	---	3, 799	---

[1] Small projects, contracts from $0 to $99,999; large projects, contracts of $100,000 or over.

Source: Tabulations made by Federal Emergency Administration of Public Works, Projects and Statistics Division.

PROPORTION OF CONTRACTS AWARDED WITHIN DIFFERENT PERIODS AFTER ALLOTMENT

NON-FEDERAL PROGRAM

FIG. 4—BUILDINGS

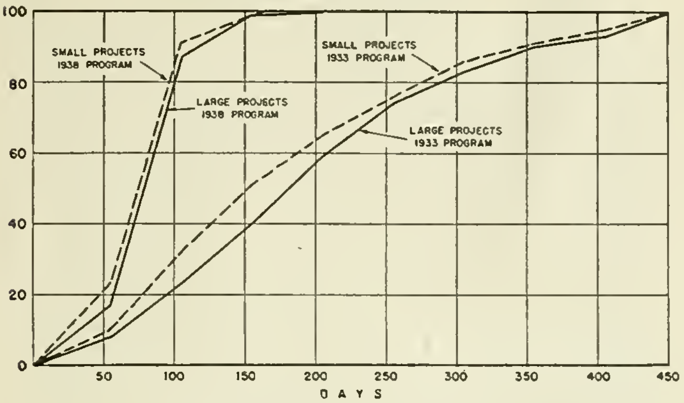


FIG. 5—STREETS & HIGHWAYS

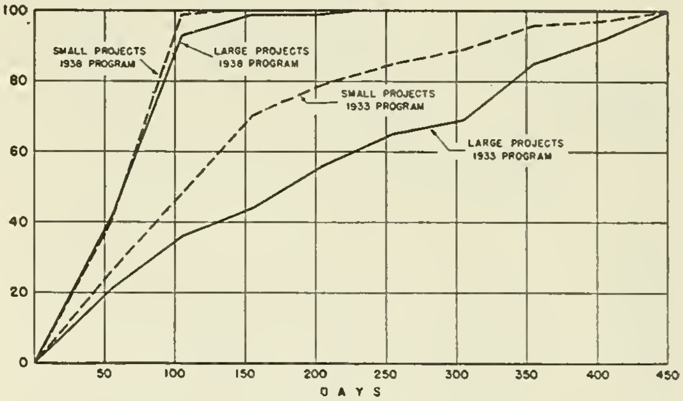
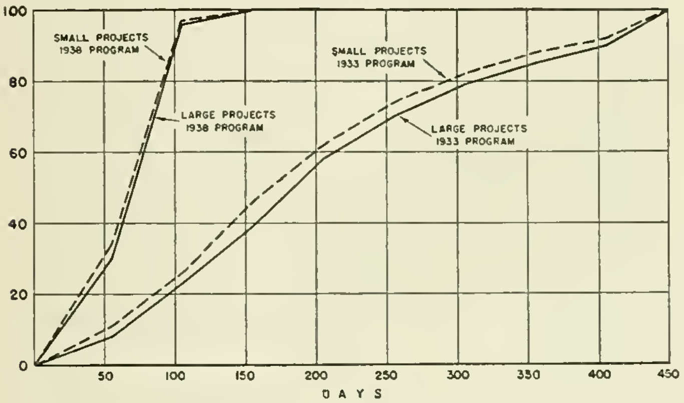


FIG. 6—SEWERS, WATERWORKS, ETC.



7—ENGINEERING STRUCTURES

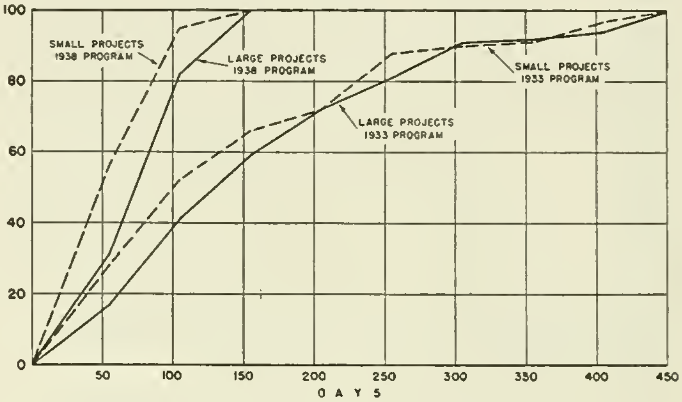


TABLE 9.—*Elapsed time between award of contract and start of construction*

	Contracts awarded in winter months,[1] all areas			Contracts awarded in frost-free months, all areas			Contracts awarded in winter months,[1] frost area [2]			Contracts awarded in nonfrost area or frost-free months, frost area			Projects costing under $100,000			Projects costing over $100,000		
	Days elapsed	Number in each class	Average	Days elapsed	Number in each class	Average	Days elapsed	Number in each class	Average	Days elapsed	Number in each class	Average	Days elapsed	Number in each class	Average	Days elapsed	Number in each class	Average
Buildings	2,147	48	45	532	14	38	1,493	31	48	1,186	31	38	1,296	34	38	1,383	28	49
Water mains	175	4	44	212	4	53	147	3	49	240	5	48	178	4	45	209	4	52
Sewage disposal and treatment plants	393	8	49	28	1	28	314	7	45	107	2	53	149	4	37	272	5	54
Pumping and filtration plants	801	13	62	114	5	23	622	10	62	293	8	37	519	9	58	396	9	44
Highway construction and paving	1,915	27	71	461	19	24	824	11	75	1,552	35	44	1,445	31	47	931	15	62
City street paving	861	8	108	40	2	20	768	7	110	133	3	44	436	5	87	465	5	93
Highway bridges	737	10	74	145	3	48	381	4	95	501	9	56	426	6	71	456	7	65
Sewers	943	14	67	244	3	81	630	9	70	557	8	70	827	10	83	360	7	51
Heavy bridges	237	4	59	156	6	26	192	3	64	201	7	29	------	------	------	393	10	39
Grade crossing elimination	143	4	36	130	4	32	143	4	36	130	4	33	124	3	41	149	5	30
Miscellaneous	181	10	18	312	18	17	127	8	16	366	20	18	183	9	20	310	19	16
Total	8,533	150	57	2,374	79	30	5,641	97	58	5,266	132	40	5,583	115	49	5,324	114	47

[1] Winter months: November to February, inclusive. Other months assumed to be frost free.

[2] Frost States: Colorado, Connecticut, Delaware, Idaho, Iowa, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, Wisconsin, and Wyoming. Nonfrost States: Alabama, Arizona, Arkansas, California, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nevada, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, and West Virginia, and District of Columbia.

Total number of days elapsed on all projects, 10,907; total number of projects, 229; average time elapsed for all projects, 48 days; range of time elapsed in projects considered from 2 to 225 days.

Source: Based on data submitted by Bureau of Labor Statistics, Division of Construction and Public Employment.

TABLE 10.—*Cumulative percentages of projects started in different periods of elapsed time after award of contract*

Number of days after award of contracts	Contracts awarded in winter months, all areas—Total 150 projects		Contracts awarded in frost-free months, all areas—Total 79 projects		Contracts awarded in winter months, frost area—Total 97 projects		Contracts awarded in non-frost area or frost-free months, frost area—Total 132 projects	
	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages	Number of projects	Cumulative percentages
0–10	15	10.0	22	27.8	9	9.3	27	20.5
11–20	21	24.0	11	41.8	17	26.8	18	34.1
21–30	17	35.3	25	73.4	10	37.1	30	56.8
31–40	19	48.0	4	78.5	11	48.5	12	65.9
41–50	9	54.0	5	84.8	6	54.6	8	72.0
51–60	11	61.3	4	89.9	6	60.8	9	78.8
61–70	7	66.0	1	91.1	4	64.9	4	81.8
71–80	10	72.7	3	94.9	4	69.1	9	88.6
81–90	4	75.3	1	96.2	2	71.1	3	90.9
91–100	5	78.7	--------	96.2	4	75.3	1	91.7
101–110	15	88.7	1	97.5	11	86.6	6	96.2
111–120	7	93.3	--------	97.5	5	91.8	1	97.0
121–130	--------	93.3	--------	97.5	--------	91.8	--------	97.0
131–140	3	95.3	--------	97.5	2	93.8	1	97.7
141–150	1	96.0	--------	97.5	1	94.8	--------	97.7
151–160	1	96.7	--------	97.5	1	95.9	--------	97.7
161–170	2	98.0	--------	97.5	2	97.9	--------	97.7
171–180	2	99.3	1	98.7	2	100.0	1	98.5
181–190	--------	99.3	1	100.0	--------	--------	1	99.2
191–200	--------	99.3	--------	--------	--------	--------	--------	99.2
201–210	--------	99.3	--------	--------	--------	--------	--------	99.2
211–220	--------	99.3	--------	--------	--------	--------	--------	99.2
221–230	1	100.0	--------	--------	--------	--------	1	100.0

Source: Based on data collected by Bureau of Labor Statistics, Division of Construction and Public Employment.

well before the winter sets in. More important, there is evidence that for some classes of construction the chances of interruption are lessened if progress has been made on the job before the winter months. If work is under way on a building, for example, there is less chance of suspension on account of weather than there is of delay for this reason if work has not started at all. Reduction of seasonality of construction employment is likely to be a worthy objective whatever the requirements in timing and flexibility. Since 1933, however, the late autumn and early winter have been the periods when most contracts have been awarded. The effect has been to maximize the time between awarding of contracts and the beginning of construction. Seasonality of employment has been greater than had contracts been distributed throughout the year with perhaps the heaviest concentration in August, September, and October.

Authorization to Beginning of Construction

It is now possible, by way of summary, to estimate very roughly the amount of time which will elapse between a decision to expand a public works program and the actual start of construction on a substantial proportion of the projects. Once again, it must be emphasized, the objective is not the shortest possible time for the period; speed has only been important in past years because of late appropriations and the need thereafter to make up for lost time and to produce results. A satisfactory public works program each year would not start from "scratch" but would be subject to more gradual expansion or contraction as the occasion required. The important thing, as suggested in the first chapter, is to know in advance what the effects will be and when they will come. In examining recent experience as a basis for estimating these effects, it is not assumed that all past practices will hold in the future. Taking non-Federal construction first, and using the 1938 experience strictly as a guide, little of the program will be under contract award before 50 days and it will be substantially (about 90 percent) under contract award after 100 days. If the period of contract awarding comes in the late autumn or winter about 100 to 110 days will have elapsed after contracts are awarded before construction is underway on 90 percent of the total number of projects. A difficulty arises in putting these two time periods together since progress toward start of construction will have been made on some projects before contracts are awarded on others. The range, however, will be from a minimum of perhaps 150 to a maximum of 210 days after the authorization of a non-Federal program before construction is generally under way. Possibly a 6-months period would be a fair guess. By the same calculation it will be between 3 and 4 months before work has started on half of the projects.

If the period of contract awarding comes in the summer months the time will be much shortened. Construction will have started on substantially all of the projects within 110 to 160 days after authorization of the expanded program, with perhaps 4½ months as a median estimate. Work on half of the projects will have started within 70 to 100 days. For non-Federal construction and apart from weather interruptions, a 4 months' lag between a decision to increase works and actual construction would appear to be a reasonable working estimate. When contracts are awarded in the later autumn or early winter, a similar estimate cannot be made since a change in the allotment-to-contract-award period may be compensated by a change in the contract-award-to-construction period, as the beginning of work, in any case, may be laid over until spring.

For Federal construction the elapsed time from a decision to expand to the beginning of construction generally will be less. Taking the allotment-to-contract-award period as 42 days, the total period to beginning of construction on substantially the whole program should not exceed 90 days in the summer, with some further shortening still possible. If the contracts are awarded in the late autumn or winter it will be perhaps 60 days longer before construction is generally under way. This delay has not been so important with past Federal programs, for the short allotment-to-contract-award period has made it possible to get Federal construction under way before the winter months, in spite of late appropriations. Against the 4-month estimated period for non-Federal construction, one can perhaps suggest a 2½-month "lag" between authorization and beginning of general construction activity for Federal construction.

Beginning to Completion of Construction

For an anlysis of the period from start to completion of public works construction, two sets of data are available. The PWA has made tabulations of the time from beginning to end of construction for 7,893 projects now completed.[10] These, however, include only projects in the non-Federal program costing a million dollars or less. Such over-all tabulations do not, of course, tell anything of the distribution of employment and material purchases within the period of construction. For a study of this, and also to obtain coverage of Federal as well as non-Federal construction, it has been necessary to study sample construction projects from records filed with the Bureau of Labor Statistics by contractors engaged on public works construction. In cooperation with the Bureau of Labor Statistics, the employment and, so far as the data permit, the material orders during the course of construction have been analyzed for projects covering all classes of construction. In the present section the over-all time from start to completion of construction is analyzed on the basis of PWA tabulations. Subsequent sections are based on the samples of individual projects from the Bureau of Labor Statistics.

For purposes of analysis of time to completion, 17 major classes of non-Federal construction were set up: Specifically, water mains, storm and combined sewers, water storage, waterworks and sewers, electric distribution and power plants, streets and highways, sanitary sewers, sewage disposal plants, waterworks, gas plants, power and waterworks, hospitals, bridges, college and university buildings, filtration plants, public buildings, and secondary school buildings. Each of these groups was broken down again into eight size classifications ranging between $10,000 and $1,000,000.

Examination of table 11 and figures 8 to 13 shows that both the size and kind of construction have a substantial effect on the time required to complete construction. Of the two, size is much more important. To take one example, the average time required to complete 43 projects costing between $10,000 and $25,000 for the laying of water mains was 10.8 weeks. The average time for 447 secondary school buildings in the same cost range was 21 weeks. The average time to complete 7 water-main projects costing between $500,000 and $750,000 was 58 weeks; 52 school buildings in the larger cost range required, on the average, about 70 weeks for completion. With increasing size both classes of projects showed a marked increase in the time to completion, but the absolute difference in time between the two classes did not change.

The increase in time required for completion is not, however, at a constant rate as size increases. In figures 8 to 13 the average weeks to completion for

TABLE 11.—*Average number of weeks required to complete various types of non-Federal projects of different sizes* [1]

	Size 1—$10,000 to $24,999	Size 2—$25,000 to $49,999	Size 3—$50,000 to $74,999	Size 4—$75,000 to $99,999	Size 5—$100,000 to $249,999	Size 6—$250,000 to $199,999	Size 7—$500,000 to $749,999	Size 8—$750,000 to $999,999
Water mains	10.8	16.0	21.6	28.0	33.4	43.6	58.0	67.3
Storm and combined sewers	12.7	16.2	22.8	29.2	39.7	48.4	57.8	69.0
Water storage	13.0	22.0	27.4	28.6	30.4	46.3	57.6	69.4
Waterworks and sewers	13.8	23.3	28.8	34.2	43.6	57.9	60.4	73.2
Electric distribution and power plants	15.4	21.6	26.0	32.9	40.8	49.7	62.3	74.0
Streets and highways	15.4	18.9	23.0	27.9	33.2	42.0	59.0	69.0
Sanitary sewers	15.6	19.6	26.3	36.0	42.4	52.3	58.4	66.2
Sewage disposal	18.1	25.1	33.8	39.5	48.0	61.3	75.5	87.5
Waterworks	18.3	27.1	32.7	37.6	43.3	56.3	63.3	71.0
Gas plants	18.8	22.6	24.8	27.3	39.2	48.6	60.3	72.0
Power and waterworks	19.0	28.8	37.9	40.0	45.8	63.4	78.2	89.0
Hospitals	19.6	30.5	37.8	43.3	58.8	66.0	75.8	81.9
Bridges	19.6	26.4	35.9	39.1	43.6	60.1	72.4	83.8
Colleges and universities	19.9	29.3	39.8	45.3	49.1	57.6	63.7	75.0
Filtration plants	19.9	24.4	29.4	33.2	42.8	51.2	64.5	76.3
Public buildings	20.4	28.9	36.0	45.3	48.5	64.2	74.4	86.0
Secondary schools	21.0	29.1	33.1	39.0	45.1	61.8	69.8	79.7

[1] Based on an analysis of construction duration of 7,893 completed non-Federal projects. Elapsed time is measured from the date construction begins to the date when all work is in place.

Source: Federal Emergency Administration of Public Works, Projects and Statistics Division.

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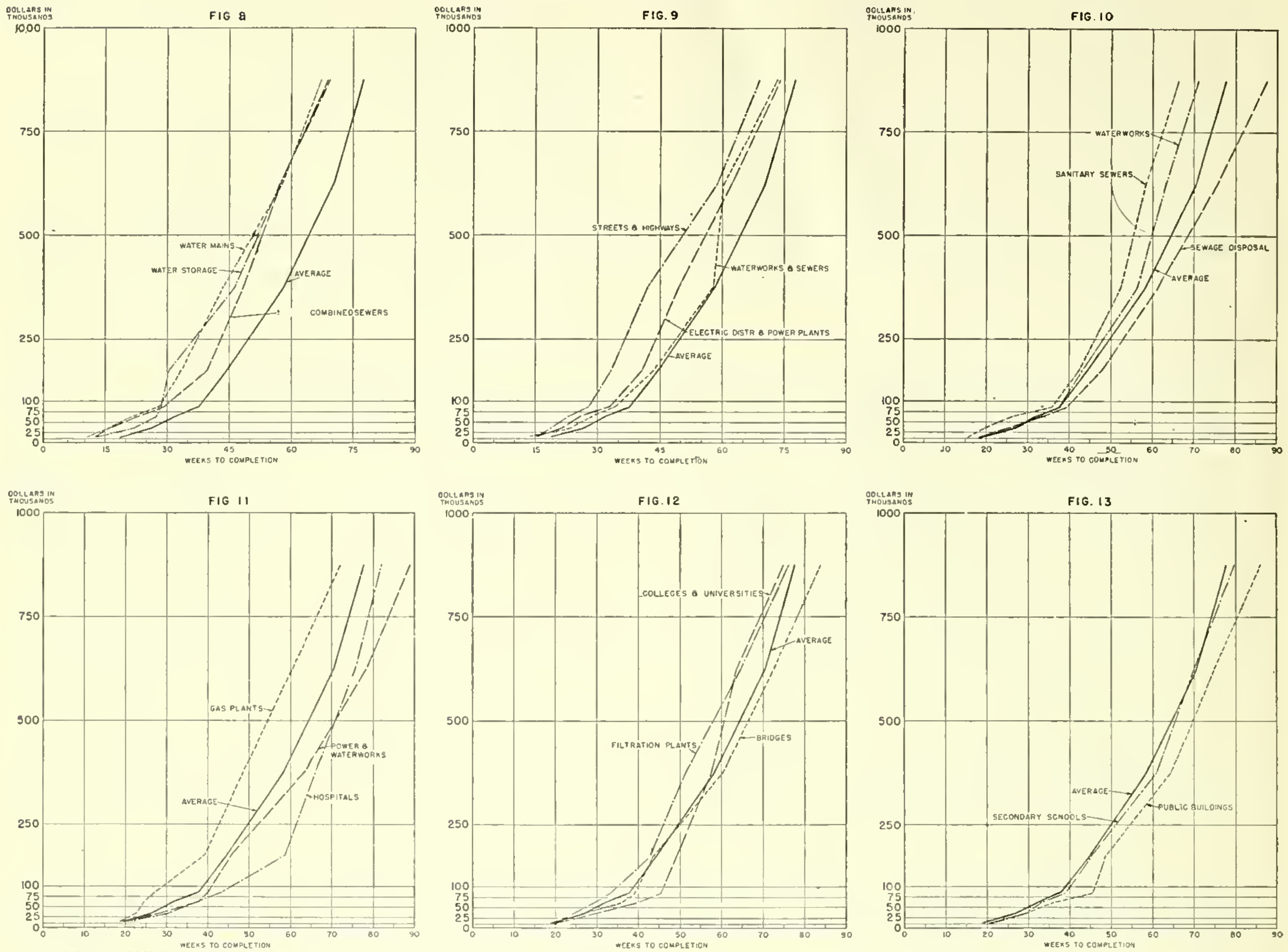
[10] These are projects which, in some sense, bad a normal history during construction. Projects where litigation, weather, and strikes caused long interruptions, and those of a miscellaneous or special character, were not included.

AVERAGE NUMBER OF WEEKS REQUIRED TO COMPLETE VARIOUS TYPES OF NON-FEDERAL PROJECTS OF DIFFERENT SIZES[1]



[1] BASED ON AN ANALYSIS OF CONSTRUCTION DURATION OF 7,893 COMPLETED NON-FEDERAL PROJECTS
SOURCE FEDERAL EMERGENCY ADMINISTRATION OF PUBLIC WORKS PROJECTS AND STATISTICS DIVISION

each class of projects in each size group are plotted at the midpoint of the size group. In the lower cost ranges ($100,000 or less) an increase in cost in all cases brings a sharp increase in the time required for completion. As projects increase in size beyond $100,000 the time required for completion continues to increase but at a less rapid rate.[11] This is especially clear for sewage disposal, waterworks, and sanitary sewer projects shown in figure 10. The average time to complete sanitary sewers in the $10,000 to $25,000 class was 15.6 weeks, and in the $75,000 to $100,000 class it was 36 weeks, or more than double. The $100,000 to $250,000 class, on the other hand, averaged only a little over 42 weeks, and the $500,000 to $750,000 only 58 weeks. Since there are fewer large projects than small ones (and for the large projects, probably, a somewhat greater dispersion from the mean[12]), the conclusions are less secure for the larger construction than the smaller. On the other hand, the behavior of this time pattern, with increasing cost, seems sufficiently uniform over all classes of construction so that it may be taken as established.

To summarize in terms of months, projects costing between $10,000 and $25,000 require for completion about 3 to 5 months, on the average, depending on the kind of construction. This time, in general, is a little less than doubled for projects between $50,000 and $75,000, and more than doubled for projects of from $75,000 to $100,000. The range in average time for the latter for different types of projects is about 9 to about 11 months. The time is again a little more than doubled (although the increase in cost is much greater) for projects costing between $500,000 and $750,000 where the range in the averages is 14 months to about 20 months.

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[11] Since the analysis deals with the average time for projects within a cost interval, and the average therein may vary from one group to another, the figure of $100,000 is only a very rough approximation.

[12] Unfortunately measures of dispersion were not made in the basic tabulations employed here.

Turning to the effect of the kind of construction on construction time,[13] it may be observed, in general, that projects involving excavation and simple construction take the least time, and buildings and heavy construction take the longest. Thus, for projects costing between $10,000 and $25,000, the average time for water mains, sewers, and water storage was from one-half to two-thirds that required for buildings and bridges. Streets and highways, waterworks, power plants and sewage disposal plants come in between in time required. In a general way, this order holds throughout the various size groups, with streets and highways increasing somewhat less rapidly than other classes in required time as cost rises. For projects under $50,000, the water main, sewer, and water storage groups take roughly 6 to 12 weeks (1½ to 3 months) less to completion than the building group. For projects above $500,000 in cost, they take on the average perhaps 8 to 20 weeks (2 to 5 months) less.[14] In other words, the larger the project the greater the absolute difference in time required for buildings and like construction, over the laying of sewer and water lines and excavation projects in general. Obviously, however, the importance of this difference relative to the total time required diminishes as projects are increased in size. The larger street and highway projects, the evidence would suggest, proceed to completion about as rapidly as any other kind of construction of similar scale.

The geographical location of the project, as affected by frost and weather conditions, is also a factor in the time required for construction, although it would not appear to be of great importance. The PWA has tabulated the average time to complete 6,489 non-Federal projects divided between northern and southern States (table 12).[15] The tabulation covers nine major classes of construction and is distributed over size classifications from $10,000 to $750,000, with the same intervals hitherto employed. For the various size classifications and types of construction, it has taken on the average from 1 to 10 weeks longer to complete construction in the North as compared with the South.

TABLE 12.—*Average number of weeks required to construct non-Federal projects, by size and type of project (according to geographic location), based on an analysis of construction duration on 6,489 non-Federal projects*

	North [1]		South [2]		Difference [3]
	Average number of weeks	Number of projects	Average number of weeks	Number of projects	
	$10,000 to $24,999				
Bridges	22.5	19	17.6	4	4.9
Colleges and universities	--------	--------	--------	--------	--------
Hospitals	23.0	3	18.6	4	4.5
Public buildings	21.6	43	18.9	31	2.7
Sanitary sewers	16.1	23	14.1	7	2.0
Secondary schools	23.9	190	19.7	222	4.2
Sewage disposal plants	20.4	17	15.6	16	4.8
Streets and highways	15.8	49	14.2	8	1.6
Waterworks	19.3	117	17.1	94	2.2
	$25,000 to $49,999				
Bridges	28.9	31	23.7	3	5.2
Colleges and universities	32.7	12	27.1	19	5.6
Hospitals	32.8	24	26.5	13	6.3
Public buildings	30.5	94	25.5	71	5.0
Sanitary sewers	23.5	30	16.3	26	7.2
Secondary schools	30.2	538	27.0	414	3.2
Sewage disposal plants	26.1	77	23.7	63	2.4
Streets and highways	19.3	136	17.8	25	1.5
Waterworks	29.7	199	25.2	265	4.5
	$50,000 to $74,999				
Bridges	36.2	10	33.0	1	3.2
Colleges and universities	43.4	9	38.4	24	5.0
Hospitals	39.5	16	35.9	14	3.6
Public buildings	38.0	59	33.0	38	5.0
Sanitary sewers	30.6	24	22.5	12	8.1
Secondary schools	34.9	352	32.1	216	3.8
Sewage disposal plants	36.2	59	29.3	31	6.9
Streets and highways	23.6	64	20.9	22	2.7
Waterworks	33.4	127	31.5	74	1.9
	$75,000 to $99,999				
Bridges	--------	--------	--------	--------	--------
Colleges and universities	46.4	8	44.7	13	1.7
Hospitals	44.5	26	41.6	10	2.9
Public buildings	47.4	44	41.7	24	5.7
Sanitary sewers	38.1	12	33.5	10	4.6
Secondary schools	39.9	220	38.0	103	1.9
Sewage disposal plants	40.0	34	38.8	25	1.2
Streets and highways	28.0	63	27.6	13	.4
Waterworks	38.6	33	36.7	44	1 9
	$100,000 to $249,999				
Bridges	44.0	13	39.8	5	4.2
Colleges and universities	50.1	22	48.4	29	1.7
Hospitals	61.5	71	51.2	27	10.3
Public buildings	50.0	101	45.4	57	4.6
Sanitary sewers	43.4	27	41.8	16	1.6
Secondary schools	46.4	410	44.1	140	2.3
Sewage disposal plants	49.0	82	45.7	18	3.3
Streets and highways	33.4	114	32.6	33	.8
Waterworks	44.3	62	41.9	50	2 4

See footnotes at end of table

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[13] Caution must be used in interpreting the effect of kind of construction in table 11 and figs. 8 to 13. Since, as noted above, the average cost of different kinds of projects varies within the general cost groups, and since size or cost is important, these variations may affect the time required for different classes of construction.

[14] The number of the larger projects is small and this range cannot be stated with any precision.

[15] The Northern States cover PWA regions 1, 2, 4, and 7, including the States of: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, Illinois, Indiana, Michigan, Ohio, West Virginia, Wisconsin, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Iowa, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wyoming, Idaho, Oregon, Washington, and Alaska. The Southern States cover PWA regions 3, 5, and 6 and include the States of: Alabama, Colorado, Kansas, Louisiana, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, Arkansas, New Mexico, Oklahoma, Texas, Arizona, California, Nevada, and Utah.

TABLE 12.—*Average number of weeks required to construct non-Federal projects, by size and type of project (according to geographic location), based on an analysis of construction duration on 6,489 non-Federal projects*—Continued.

	North [1]		South [2]		Difference [3]
	Average number of weeks	Number of projects	Average number of weeks	Number of projects	
	$250,000 to $499,999				
Bridges	60.5	10	58.7	3	1.8
Colleges and universities	60.1	19	53.6	12	6.5
Hospitals	67.4	28	64.5	10	2.9
Public buildings	65.1	24	62.8	13	2.3
Sanitary sewers	56.9	16	47.3	7	9.6
Secondary schools	61.0	116	62.2	33	1.2
Sewage disposal plants	63.2	35	55.9	9	7.3
Streets and highways	42.4	36	39.0	5	3.4
Waterworks	59.9	13	51.3	6	8.6
	$500,000 to $749,999				
Bridges	--------	--------	--------	--------	--------
Colleges and universities	66.3	3	62.4	6	3.9
Hospitals	77.8	12	72.4	6	5.4
Public buildings	75.1	8	73.0	4	2.1
Sanitary sewers	--------	--------	--------	--------	--------
Secondary schools	70.1	32	69.0	17	1.1
Sewage disposal plants	75.5	18	--------	--------	--------
Streets and highways	60.2	6	57.2	4	3.0
Waterworks	--------	--------	--------	--------	--------

[1] North—PWA regions 1, 2, 4, and 7: Alaska, Connecticut, Delaware, Idaho Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennyslvania, Rhode Island, South Dakota, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

[2] South—PWA regions 3, 5, and 6: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Kansas, Kentucky, Louisiana, Mississippi, Nevada, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Utah, and Virginia.

[3] Average construction period in North exceeds that of South for all groups except secondary schools in $250,000–$499,999 class.

Source: Federal Emergency Administration of Public Works, Projects and Statistics Division.

In the majority of classes, however, the average additional time required in the North was 3 weeks or less. There appears to be no substantial difference between different classes of construction with the exception of streets and highways, where the additional time required in the northern States was nominal. It is apparent that highway work is nearly as subject to interruption from wet and inclement weather in the South as from frost conditions in the North.

It is perhaps safe to assume that approximately the whole of the difference in rate of construction, as just indicated, is the result of weather conditions. It should not be concluded, however, that the difference between the North and the South represents the total effect of weather. There is evidence, from the examination of the record of individual construction projects, of considerable interruption in construction in the South as well as the North during the winter months. Moreover, some northern States are more seriously affected than others, and the extremes are lost in the average shown here.

It may be repeated also that the effect of the weather factor cannot be dismissed as inevitable. The preceding section has shown the delay in the beginning of construction attributable to the launching of all of the past programs during the autumn months. But in many cases, particularly building construction, it appears to be also necessary that a certain minimum of construction be done if work is to continue through the winter without interruption. Specifically, if the excavation is completed, and the foundations are laid before frost sets in, there is a good chance that work on the superstructure may continue throughout the winter. If the foundations are not complete before frost, the likelihood of an interruption is, apparently, somewhat increased. Thus, appropriate "seasonal" timing of the program is important, not only for the period before construction begins but during the period of construction also.

Rate of Employment After Beginning of Construction on Different Classes of Projects

The purpose of the following sections is to discover the actual on-site employment behavior of various types and sizes of public works over the period from the start to the completion of construction. If characteristic "labor patterns" can be linked to specific projects, it becomes possible to forecast with reasonable accuracy the aggregate labor pattern of a program consisting of hundreds or thousands of individual projects. Or, more positively, it may be possible to arrange the timing of individual projects, the projects having already been selected on the basis of other criteria, so that the aggregate employment to be provided by the program will be distributed monthly in the desired manner.

Assume, for example, that the objective of a future Federal works program should be the employment of as many men as possible, as quickly as possible, and also the subsequent maintenance of a fairly even level of employment throughout the life of the program. On the basis of the material presented in previous sections, we know the approximate lags involved in getting actual construction underway. If, in addition, we know the approximate patterns which the employment on various project types follows, then those projects on which employment characteristically reaches its peak most quickly can be given precedence, and the other projects involving various degrees of delay can be spaced so as to provide a reasonably even level of employment on the program as a whole. The larger the program, of course, the greater are the possibilities of this type of planning. The possibilities are substantially narrowed when a break-down by States or localities is considered, rather than the program in its entirety.

The patterns presented below have been constructed from a sample of 249 projects. The monthly distribution of the total on-site man-hours provided at the site of construction has been tabulated for this study by the Bureau of Labor Statistics. These projects have been drawn from both Federal and non-Federal construction and from all of the programs since 1933. It should be emphasized, however, that such a small sample, when broken down into size groups and project types, does not provide an adequate base for the determination of detailed and exact patterns. Further investigation was not possible within the limitations of the present study, and the subject represents a field deserving of more complete analysis in the future.[16] All that can be offered now is an approximate outline of the employment distribution of a limited number of general types and sizes.

In the following pages, projects have, in general, been combined into a size group only when three or more individual projects of that size and type are available from the sample. The remainder have been treated as miscellaneous projects having little significance other than as illustrations of the labor patterns of the particular projects in question. The small number of projects in most of the size- and type-groups, made necessary by the small aggregate sample, allows substantial distortion of patterns resulting from the peculiar behavior of a single project. Building projects and small- and medium-sized highway construction and paving projects constitute the only project types for which a reasonably adequate sample is available. With respect to other types and sizes, if should be kept constantly in mind that the peculiarities of an individual project may significantly affect the labor pattern of the group.

One factor which tends in some cases to distort the labor pattern is the occasional stoppage of construction on specific projects due to weather or other conditions. This stoppage may run for 2 or 3 months or more. The only group in the sample which is materially affected by this factor is highway construction and paving, and in the following analysis the monthly distribution of labor for this group has been adjusted to exclude delays on account of weather. Nevertheless, weather is an ever-present, although unpredictable, factor in construction.

Effects of Size on On-Site Labor Patterns

Previous sections have given some indication of the effect of the size of the project on the rate, both at which projects are put under contract and the rapidity with which they proceed to completion. An analysis of labor patterns during actual construction shows conclusively the importance of size in this period. Figures 14 to 23 show the percentages of total on-site man-hours provided during each month of the construction period, and also the cumulative monthly percentages, for 10 types of public works projects, broken down by size groups. The 10 project types for which the labor patterns are given are buildings, highway construction and paving, water mains, sewage disposal and treatment plants, pumping plants and filtration plants, sewers, highway bridges, city street paving, Diesel and steam engine plants, and grade-crossing eliminations. As was noted above, the sample in most of the size groups is small, as few as three projects in some, and for all of the project types except buildings, only two or three size groups are available. It should, of course, be kept in mind that only on-site man-hours are covered.

Despite the incompleteness of the data, it can be confidently stated that the size of a project is of controlling importance in determining the interval before peak employment is reached, and also the total period required for completing employment. (Subsequently it will be shown that the type of project appears to be of much less significance.) This conclusion is almost uniformly supported throughout the sample. The building classification, for which six size groups with relatively good samples are available, provides a clear illustration of the trend. For the building size group $1 to $24,999, peak employment is reached in the second and third months, and by the end of the sixth month nearly 90 percent of the total man-hours had been worked. In the next size group, $25,000 to $49,999, peak employment was reached in the third and fourth months, and 7.6 months were needed to reach 90 percent completion. The employment peaks of the remaining four groups, in order of size, were reached in the third to fourth, fifth to eighth, ninth to tenth, and sixth to seventh months, respectively; and the time required to work 90 percent of total man-hours was 8.8, 12.0, 15.7, and 27.7 months, respectively. The employment peak of each group, in addition to being somewhat delayed, with one exception, also represented a substantially lower percentage of total man-hours than that of the next larger group. This would follow naturally from the increasing time requirements for completion.

The other project types tend to follow a similar pattern, although in no case are more than three size groups available. For example, sewers of a contract size from $1 to $49,999 reach their employment peak in the second month; in the group $50,000 to $99,999, the peak is reached in the third month; and in the group $100,000 to $499,999, in the fifth month. For the same groups, respectively, 4.9, 7.4, and 9.2 months are required to reach 90 percent of total man-hours. Similarly, for pumping and filtration plants, the peaks are reached in the third to fifth, fourth to fifth, and fifth to sixth months as size increases; and 5.4, 8.3 and 12.2 months are required to reach 90 percent of total man-hours. In the case of highway bridges, the peaks occur in the second, fourth, and fifth to seventh months as the size of the group increases; and 6.7, 7.2, and 8.5 months are required for 90 percent completion. For the four project types for which only two size groups are available, the story is without exception the same. In the case of Diesel and steam engine plants the trend is broken by the size group $100,000 to $499,999, which provided employment more quickly than the $50,000 to $99,999 group. The chances are, however, that this

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[16] Reports are filed with the Bureau of Labor Statistics by each contractor and subcontractor on a construction project. Where the number of subcontracts is large, the time and expense required for tabulating the monthly distribution of man-hours (and also men employed, payrolls, and orders of materials) is considerable. An effort was made to sample widely from all classes and conditions of construction, but this inevitably reduced the number of projects of any size and type which could be analyzed.

PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY AND CUMULATIVELY BY MONTHS, ACCORDING TO SIZE GROUPS

FIG 14 - BUILDINGS (SCHOOLS, HOSPITALS AND PUBLIC BUILDINGS)

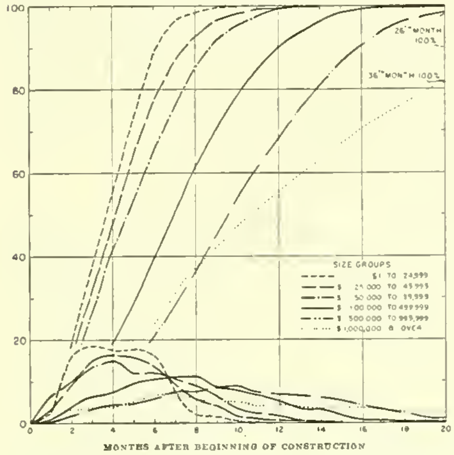


FIG 15 - HIGHWAY CONSTRUCTION AND PAVING

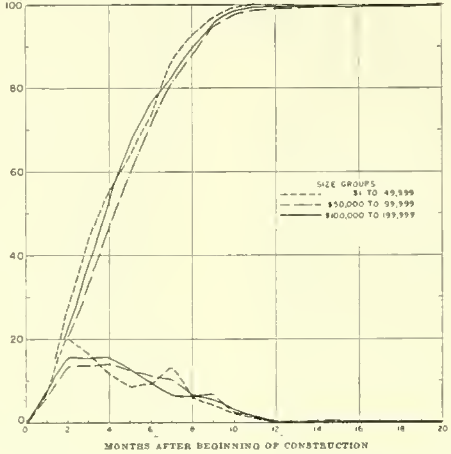


FIG 16 - WATER MAINS

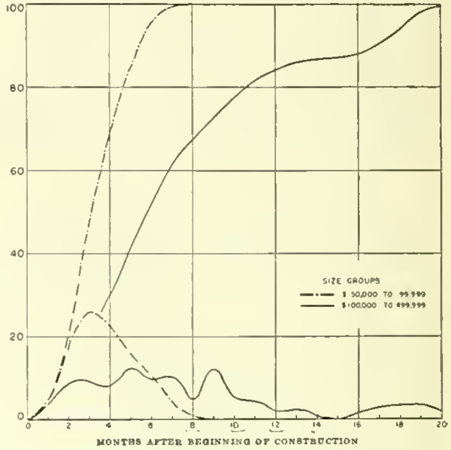


FIG 17 - SEWAGE DISPOSAL AND TREATMENT PLANTS

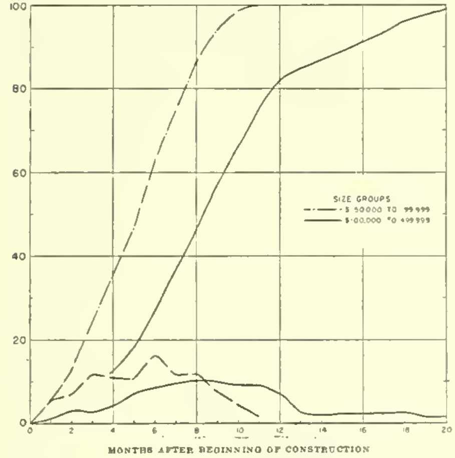


FIG 18 - PUMPING PLANTS AND FILTRATION PLANTS

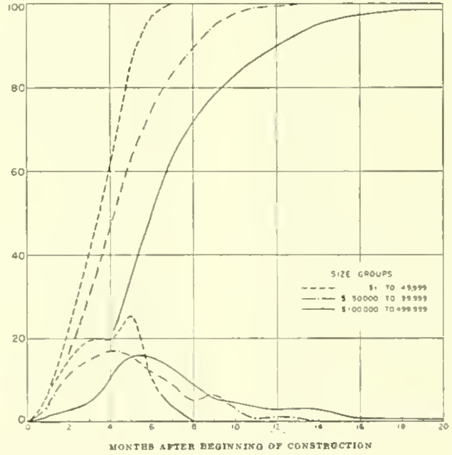


FIG 19 - SEWERS

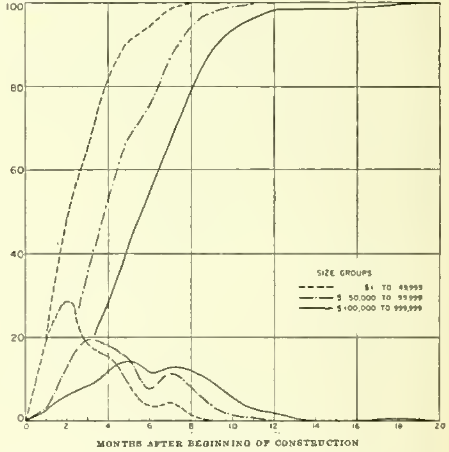


FIG. 20 - HIGHWAY BRIDGES

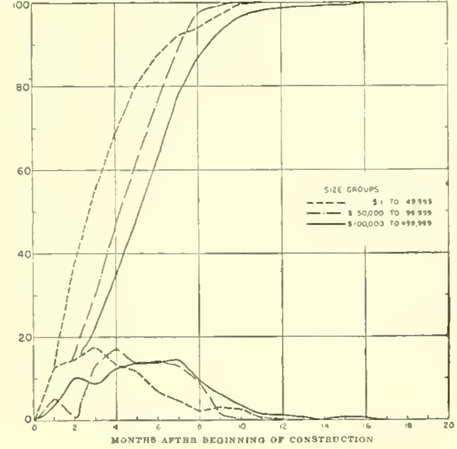


FIG. 21 - CITY STREET PAVING

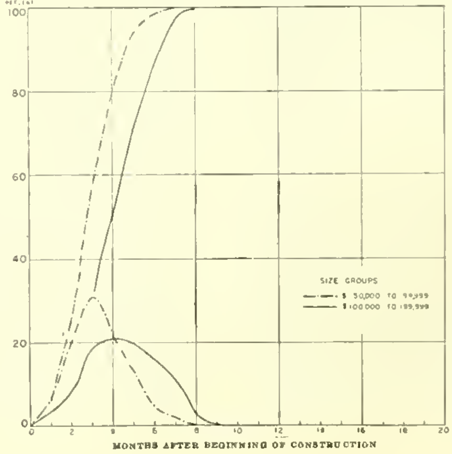
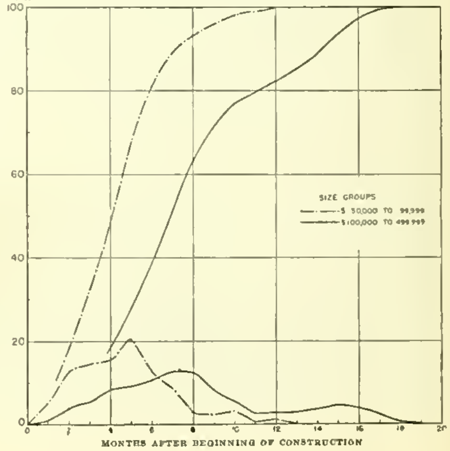


FIG. 22 - GRADE CROSSING ELIMINATION



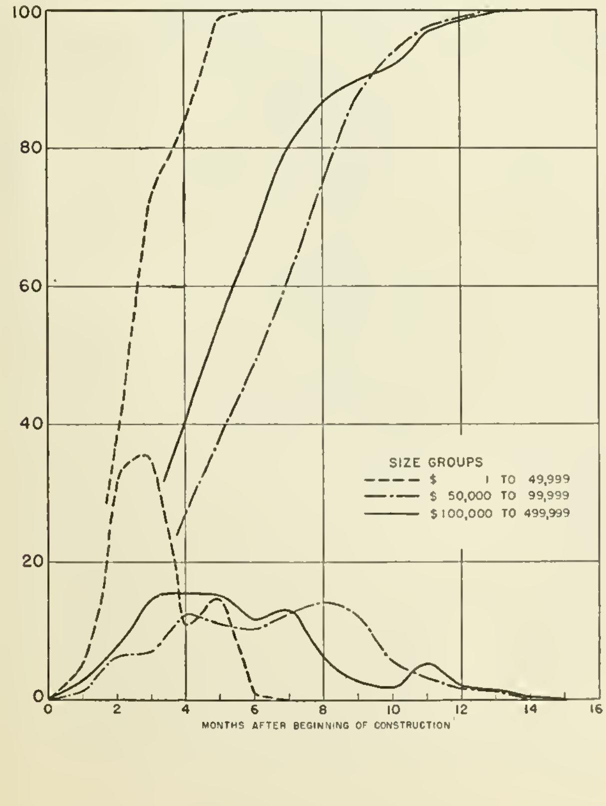
discrepancy is due to the smallness of the sample; and it should be noted that the $1 to $49,999 group moves along more rapidly than the other two groups.

The only significant exception to the general trend is the highway construction and paving classification. Here the size groups move together with substantial uniformity, all reaching their peaks in the second to fourth months and requiring 7.6, 8.4, and 8.1 months to reach 90 percent of total man-hours. Size within this sample appears to be of no moment in determining the nature of the labor pattern; if anything, the larger projects tend to move along more quickly than the medium ones. Furthermore, it should be noted that the sample of this project type is relatively good. It appears to be possible in highway construction and paving to increase the number of men and the amount of equipment to accord substantially with the size of the job which is being undertaken.

An additional method of illustrating the effects of size on the labor pattern of project types is to compare the on-site man-hour distributions provided by a specified amount—say, $10,000,000—of each size group. This has been done for nine project types in figures 24 to 32: $10,000,000 was divided by the average contract value of the projects in each size group, and the resulting number of projects per $10,000,000 was multiplied by the average number of man-hours provided. This man-hour total was then distributed by months according to the percentages characteristic of the size group in question.

PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY AND CUMULATIVELY BY MONTHS, ACCORDING TO SIZE GROUPS

FIG 23 – DIESEL AND STEAM ENGINE PLANTS



It will be observed that the total number of on-site man-hours provided by $10,000,000 of projects varies substantially between size groups. Thus, $10,000,000 of $1 to $24,999 buildings provides 4,326,830 on-site man-hours, whereas a similar volume of buildings over $1,000,000 provides only 2,544,902 man-hours. Similarly, the $1 to $49,999 group of sewer projects provides 6,028,199 man-hours, compared with 3,520,577 in the case of $50,000 to $99,999 projects and 4,171,990 for $100,000 to $199,999 projects. Only in the case of highway-construction projects and of sewage-disposal plants are the totals relatively alike for the individual size groups.

Extreme caution should be used lest too much weight be given to these variations. First, the possibility of distortion from the peculiar behavior of an individual project is always present. Second, as project size increases, the proportion of material and equipment costs to total costs probably rises, thereby expanding the number of off-site man-hours provided while decreasing the number of on-site man-hours. Third, part or all of the variation in any one case may be due to different types of construction within the general project classification. It may be accounted for by the difference between a short block of interceptor sewer pipe as compared with a long length of 6-inch pipe where the former requires a relatively large volume of material orders. Fourth, specific local conditions may affect the volume of on-site labor: a sewer set in dry earth as against one set in swampy land, or varying problems with respect to the foundations of plants or buildings, or the amount of grading necessary on a highway project. Finally, the degree of efficiency may vary on different projects, and also labor may be used in some cases as a substitute for equipment. The opportunity which is present in many types of work, for increasing use of labor-saving equipment as size increases undoubtedly explains, at least in part, the tendency in some cases for the volume of man-hours provided to decrease as the group size rises.

In order to indicate the relative amount of labor provided by different project sizes it would be necessary to include the volume of off-site labor generated—and also to enlarge greatly the sample. The calculations in figures 24 to 32 are presented at this point merely to show the volume and distribution of man-hours on the basis of the sample available, and to set off more clearly the variation in the labor patterns between different sizes of projects. For the most part the man-hours provided by $10,000,000 of $1 to $49,999 projects are concentrated in the second, third, and fourth months of operation; those provided by the $50,000 to $99,999 group in the third to sixth months of operation; and

MONTHLY DISTRIBUTION OF TOTAL ONSITE MAN-HOURS PROVIDED BY $10,000,000 OF PROJECTS, BY SIZE GROUPS

FIG 24—BUILDINGS

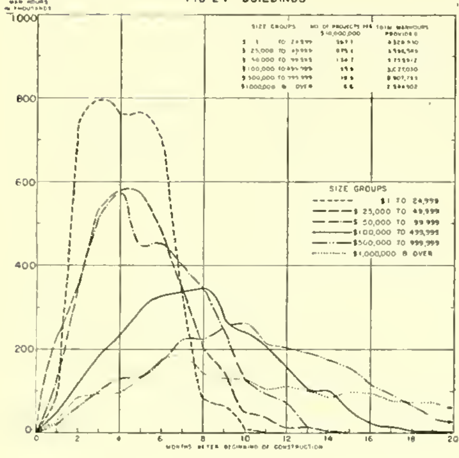


FIG.25—HIGHWAY CONSTRUCTION AND PAVING

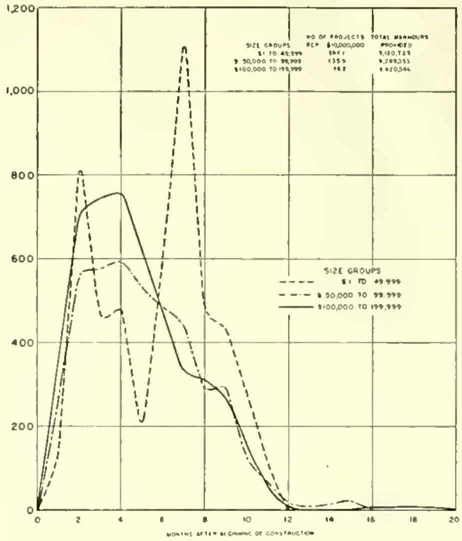


FIG. 26—WATERMAINS

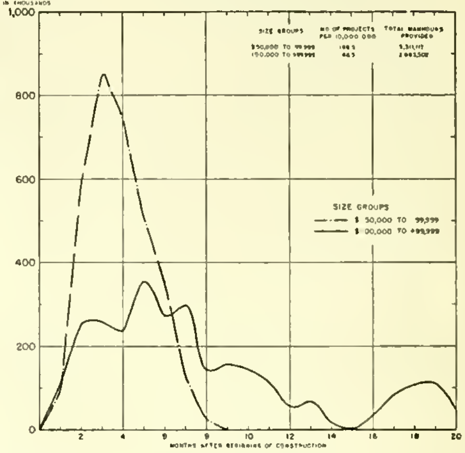


FIG. 29—HIGHWAY BRIDGES

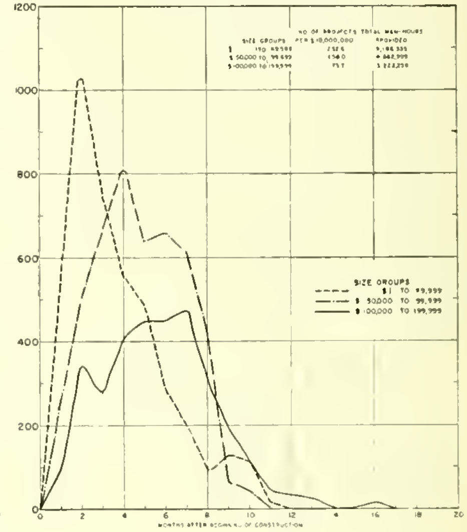


FIG 27—SEWERS

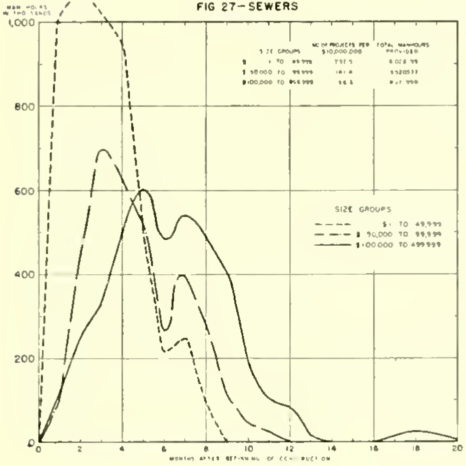


FIG. 28—PUMPING PLANTS AND FILTRATION PLANTS

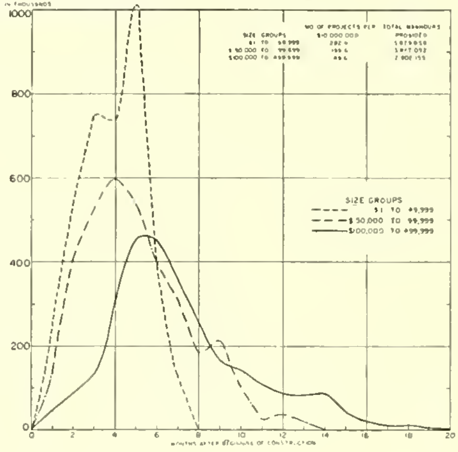


FIG 30—SEWAGE DISPOSAL AND TREATMENT PLANTS

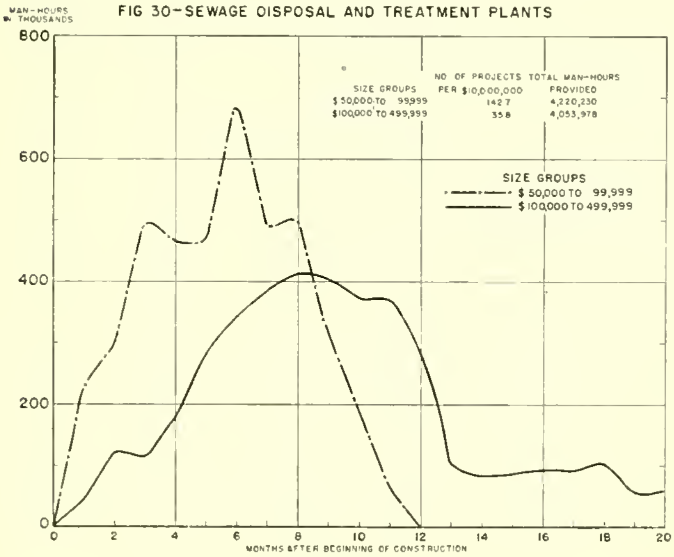
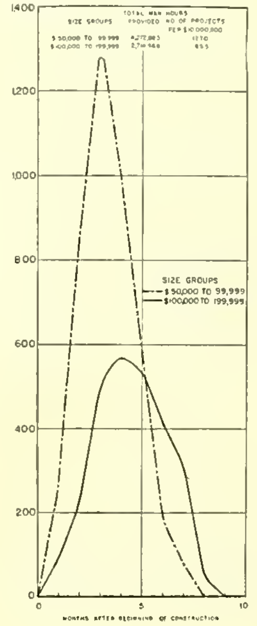
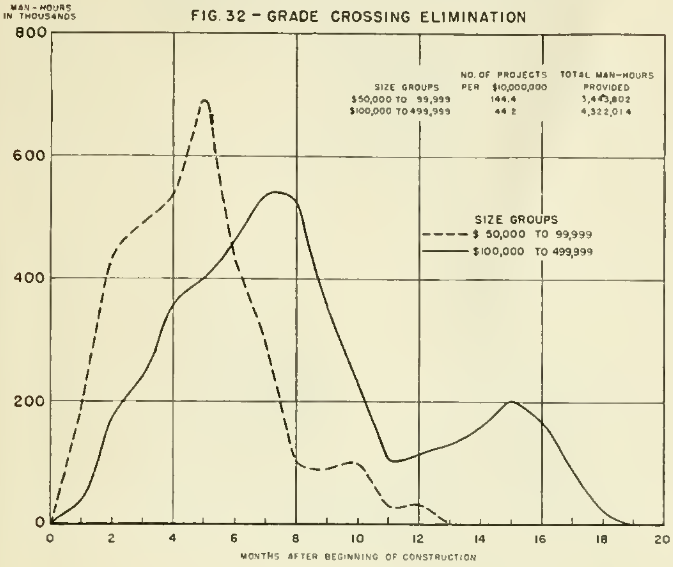


FIG 31—CITY STREET PAVING



MONTHLY DISTRIBUTION OF TOTAL ONSITE MAN-HOURS PROVIDED BY $10,000,000 OF PROJECTS, BY SIZE GROUPS

FIG. 32 – GRADE CROSSING ELIMINATION



those of the $100,000 to $499,999 group in the fourth to eighth months. Moreover, the employment peaks decrease substantially as the project size increases, and the level of employment becomes more even and is spread over a larger number of months.

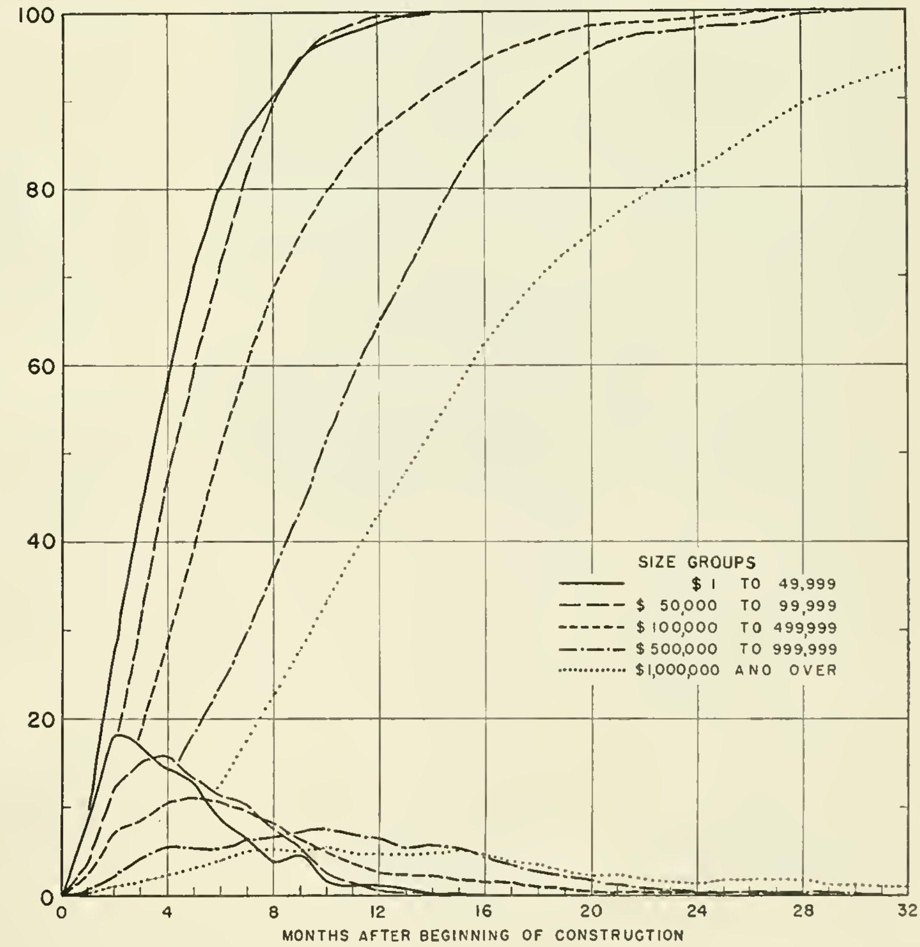
The importance of size as a determinant of the labor pattern is further illustrated by a break-down of the entire sample into size groups. Figure 33 shows the man-hours worked monthly and cumulatively by months for the different size groups combining together all of the project types. It is readily apparent that, as the size increases, the man-hour peaks become progressively lower, more delayed, and more prolonged. Thus, the smallest group, $1 to $49,999, reaches its peak in the second month; the largest group, over $1,000,000, in the eighth to tenth months. The smallest group is 90 percent completed by the eighth month, the largest group not until the twenty-ninth month. The other groups are spaced in between in accordance with their relative sizes. The analysis in terms of aggregates thus reinforces the conclusions arrived at through the break-down by project types.

The $1 to $49,999 group reaches its peak in the second month and almost coincides with the $50,000 to $99,999 group in the time required for completion. A considerably longer time is necessary to complete projects in the $100,000 to $499,999 group. The $500,000 to $999,999 group does not attain its peak until five months after the peak is reached in the $100,000 to $499,999 group, but a more stable level of employment is maintained among these projects. In the $1,000,000 or over group the peak is least pronounced and employment most stable.

In summary, the most important factor determining the rate at which public works projects begin to yield employment after the beginning of construction, is the size of the project. For all classes of construction, with the exception of highway construction and paving, small projects reach their peak employment more quickly than the large projects. A program composed

PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY AND CUMULATIVELY BY MONTHS, ACCORDING TO SIZE GROUPS

FIG. 33 – ALL PROJECTS



of projects costing less than $50,000 would provide most of its employment in the second, third, and fourth months after construction started. In contrast a program composed of projects costing between $100,000 and $500,000 would provide the bulk of the required employment in the fourth, fifth, and sixth months. As brought out in a preceding section, the time from start to completion of projects increases sharply as the size is increased. In line with this, the present analysis shows that, while the small projects reach peak employment relatively soon after the beginning of construction and are quickly completed, the employment on the larger projects is spread out over a much longer period with a much lower peak employment for a given dollar volume of expenditure. In other words, while the flexibility of the small construction is greater than the large, the durability or continuity of employment is much greater on the larger construction jobs. As an interesting byproduct, attention is again called to the apparently much larger volume of on-site employment per dollar of expenditure on the smaller as compared with the larger construction projects.

Comparison of Labor Patterns By Project Types

In contrast to the size analysis, a comparison of the labor patterns of different types of projects of the same size grouping shows, with few exceptions, no well-defined or substantial variations. Figures 34 to 38 present the monthly and cumulative percentage distributions of man-hours of different project types in five size groups. Tables 13 to 16 show by project types the deviations from the median for the group by per-

TABLE 13.—*Average deviation from group median, for different project types: $1 to $49,999*

IN MONTHS

Percent	Median	Buildings	Sewers	Diesel and steam engine plants	Highway bridges	Pumping and filtration plants	Highway construction
10	1.2	0.1	−0.7	0	−0.4	0	0
20	1.6	.6	−.6	−.1	−.3	.3	.1
30	2.0	.9	−.6	−.2	−.3	.4	.2
40	2.5	1.0	−.8	−.4	−.3	.4	.3
50	3.1	1.0	−1.0	−.7	−.4	.4	.5
60	3.7	1.0	−1.1	−1.0	−.3	.3	.9
70	4.3	1.1	−1.1	−1.4	−.2	.1	1.4
80	4.9	1.3	−1.1	−1.2	.1	−.2	1.6
90	6.1	1.4	−1.2	−1.7	.6	−.7	1.5
Average deviation		.9	−.9	−.7	−.2	.1	.7
IN THOUSANDS OF DOLLARS							
Average contract size	34.9	34.4	39.6	26.4	43.0	35.4	28.8

PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY, AND CUMULATIVELY BY MONTHS, FOR DIFFERENT PROJECT TYPES

FIG 34 - SIZE GROUP : $1 - 49,999

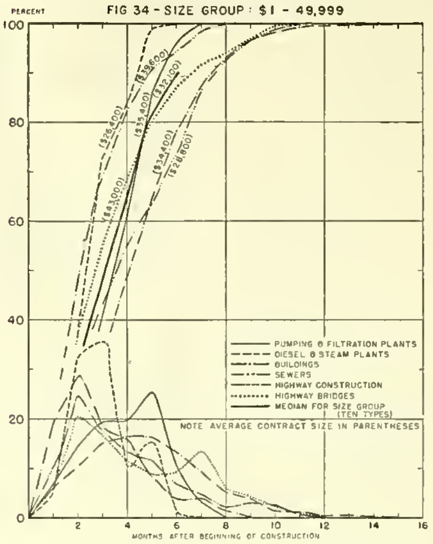


FIG 35 A - SIZE GROUP $50,000 - 99,999

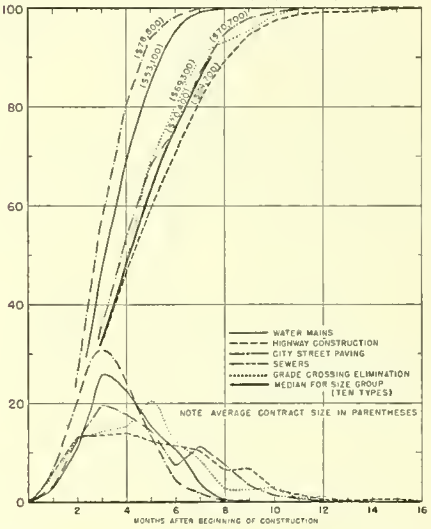
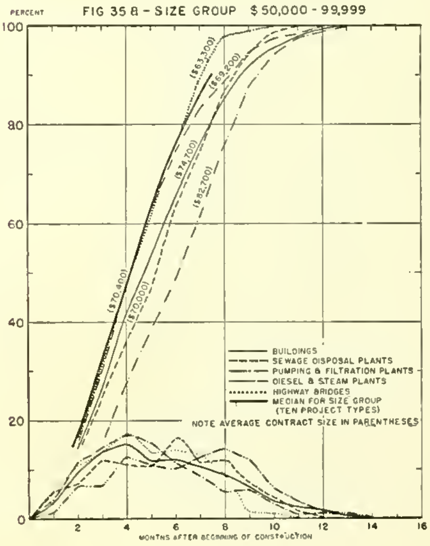


FIG 35 B - SIZE GROUP $50,000 - 99,999



PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY, AND CUMULATIVELY BY MONTHS, FOR DIFFERENT PROJECTS TYPES

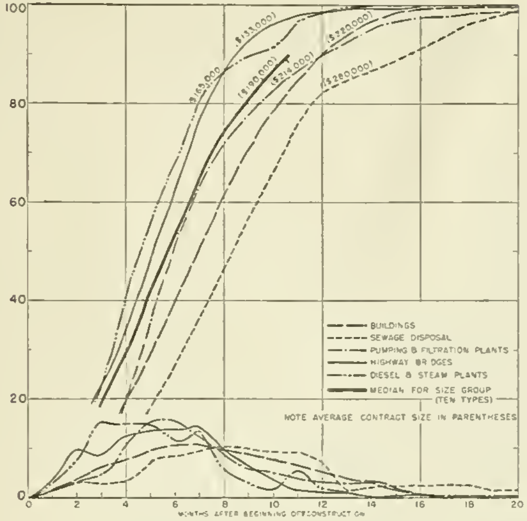


FIG 36A - SIZE GROUP - $100,000 - 499,999

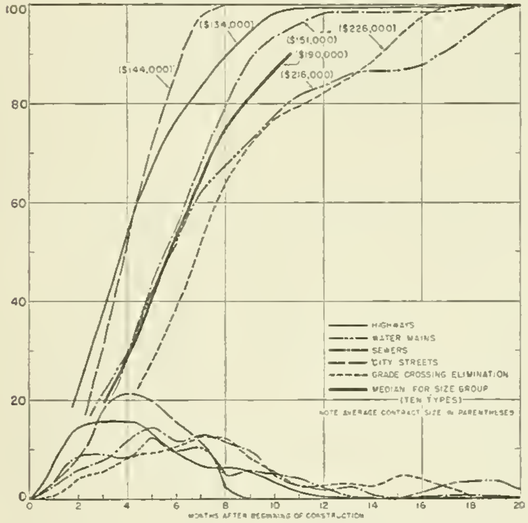


FIG 36B - SIZE GROUP $100,000 - 499,999

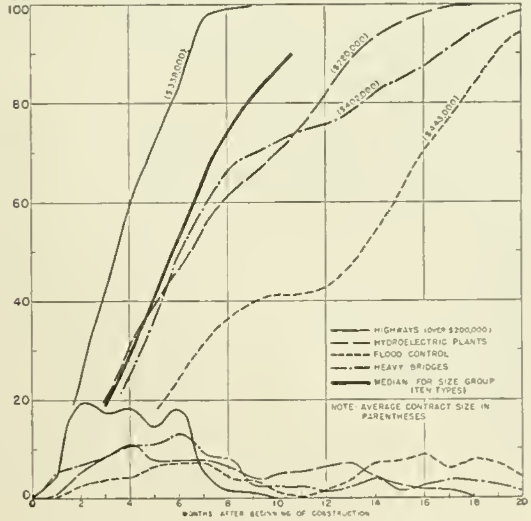


FIG 36C - SIZE GROUP $100,000 - 499,999

PERCENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY AND CUMULATIVELY BY MONTHS, FOR DIFFERENT PROJECT TYPES

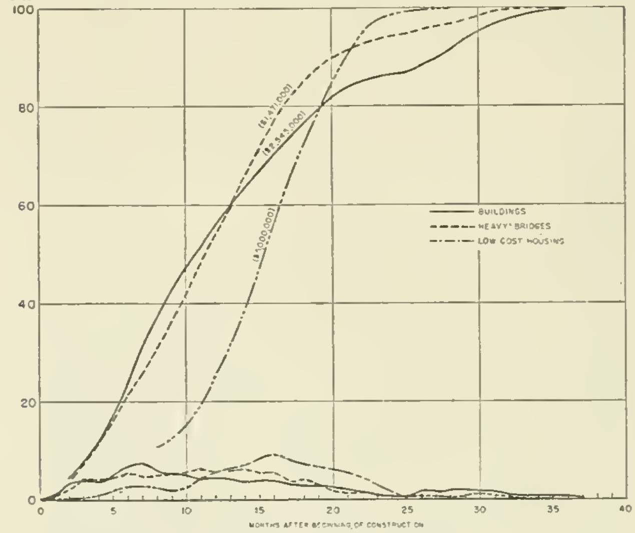


FIG 38A—SIZE GROUP $1,000,000 OR OVER

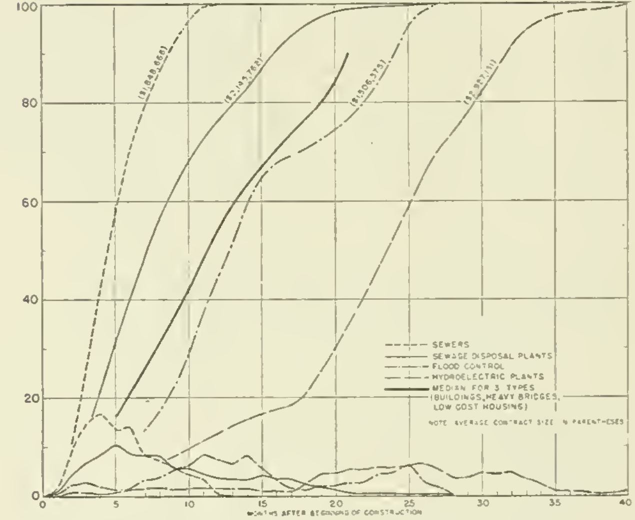


FIG 38B—SIZE GROUP $1,000,000 OR OVER

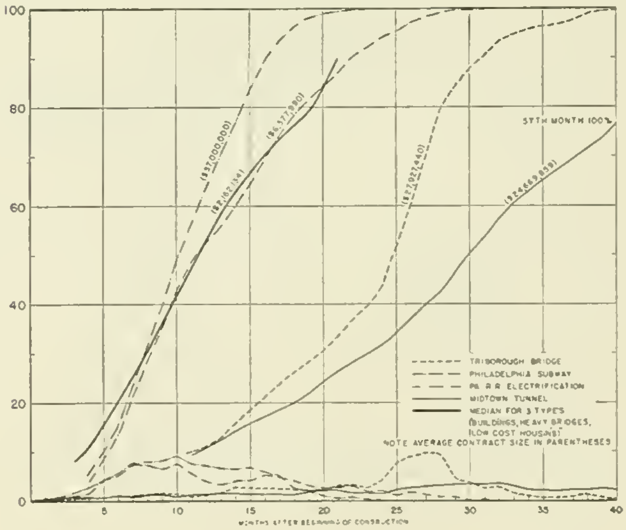


FIG 38C—SIZE GROUP $1,000,000 OR OVER

TABLE 14.—*Average deviation from group median, for different project types: $50,000 to $99,999*

IN MONTHS

Percent	Median	Buildings	Highway construction	Water mains	Sewage disposal	Pumping and filtration plants	Sewers	Highway bridges	City street paving	Diesel	Grade crossing elimination
10	1.4	−0.1	−0.1	0	0.3	0.1	0.1	0	−0.3	1.0	−0.1
20	2.2	0	−.1	−.3	.4	.1	0	0	−.6	1.2	−.1
30	2.9	0	−.1	−.6	.6	.1	−.1	.1	−.8	1.4	−.1
40	3.5	0	0	−.7	1.0	.1	−.3	.1	−1.0	1.7	0
50	4.2	−.1	.1	−1.1	1.0	0	−.4	0	−1.3	1.9	−.1
60	4.8	−.1	.3	−1.2	1.0	.1	−.3	.1	−1.5	2.1	−.2
70	5.5	−.1	.5	−1.4	1.1	.2	−.2	.1	−1.7	2.1	−.4
80	6.4	−.2	.5	−1.7	1.1	.3	0	0	−2.1	2.0	−.5
90	7.5	0	.9	−2.0	1.0	.8	−.1	−.3	−2.3	1.9	−.5
Average deviation		−.1	.2	−1.0	.8	.2	−.1	0	−1.3	1.7	−.2
IN THOUSANDS OF DOLLARS											
Average contract size	72.5	74.2	74.7	53.1	70.1	69.2	70.7	63.3	78.8	82.7	75.9

TABLE 15.—*Average deviation from group median, for different project types: $100,000 to $499,999*

IN MONTHS

Percent	Median	Buildings	Highway construction	Water mains	Sewage disposal	Pumping and filtration plants	Sewers	Highway bridges	City street paving	Diesel	Grade crossing elimination
10	2.1	0.6	−0.9	−0.4	1.6	1.0	0.1	−0.4	−0.6	−0.2	0.8
20	3.1	1.0	−1.3	−.2	2.1	1.0	.2	−.3	−.8	−.5	1.0
30	4.1	1.1	−1.6	0	2.2	.6	0	−.5	−1.3	−.8	1.1
40	4.9	1.2	−1.7	0	2.4	.4	−.1	−.5	−1.6	−1.0	1.2
50	5.8	1.2	−2.0	.1	2.5	.2	−.2	−.7	−2.0	−1.2	1.1
60	6.6	1.2	−2.1	.2	2.8	.2	−.2	−.8	−2.3	−1.3	1.1
70	7.5	1.3	−2.1	1.1	3.0	.3	−.3	−1.0	−2.7	−1.3	1.3
80	8.8	1.5	−2.2	1.9	3.0	.7	−.7	−1.5	−3.3	−1.9	2.4
90	10.7	1.3	−2.6	6.1	4.8	1.5	−1.5	−2.2	−4.3	−1.4	3.5
Average deviation		1.2	−1.8	1.0	2.7	.7	−.3	−.9	−2.1	−1.1	1.5
IN THOUSANDS OF DOLLARS											
Average contract size		220.5	133.9	216.2	279.8	214.5	151.1	133.1	144.4	165.4	226.2

TABLE 16.—*Average deviation from group median, for different project types: Over $1,000,000*

IN MONTHS

Percent	Median	Buildings	Heavy bridges	Low-cost housing
10	3.7	−0.2	0	4.0
20	5.8	−.3	0	5.3
30	7.8	−.9	0	4.9
40	9.7	−1.1	0	4.5
50	11.3	−.6	0	4.0
60	13.2	0	−.1	3.2
70	15.8	0	−1.0	1.9
80	19.3	.1	−2.5	0
90	21.0	6.7	−.7	0
Average deviation		.4	−.5	3.1
IN THOUSANDS OF DOLLARS				
Average contract size		2,545.0	1,471.0	5,000.0

centages of total man-hours worked from 10 to 90 percent; the group $500,000 to $999,999 is omitted since only buildings and certain miscellaneous projects are available for that size.

In addition to the smallness of the sample, there is a further factor which tends to distort the comparison presented in the above tables and figures. Within each size grouping the average contract size of the different project samples varies substantially. In the $1 to $49,999 group, the range is from an average of $26,400 for Diesel and steam engine plants to a $43,000 average for highway bridges. In the next group, $50,000 to $99,999, the average size of the water main sample is $53,100, while that of Diesel and steam engine plants is $82,700. In the $100,000 to $499,999 group, the range is from $133,000 for highway bridges to $280,000 for sewage disposal and treatment plants. In view of the controlling importance of size in determining the labor pattern, it is obvious that constant and substantial allowance must be made for these varying average contract sizes. In order that such allowance may be the more easily made, the average contract sizes have been placed on the figures and tables.

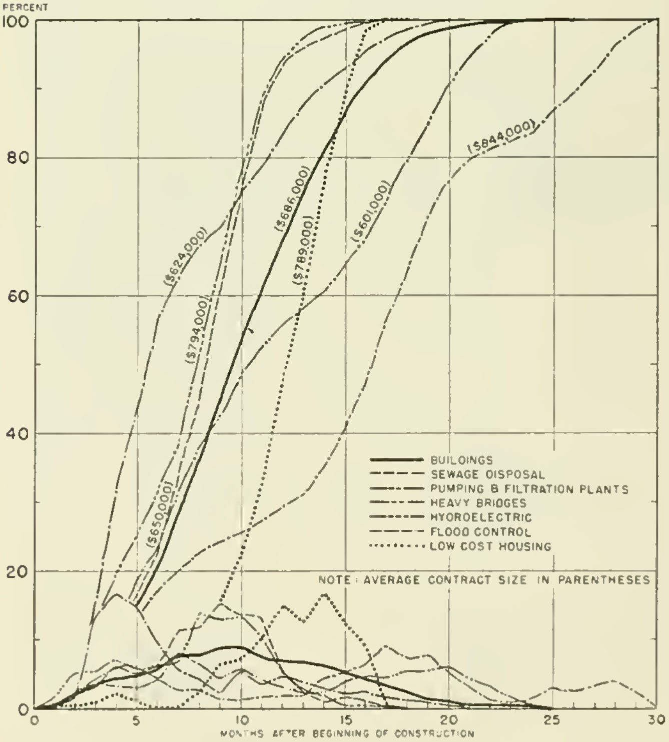
In analyzing the material presented, it is apparent that the differences in the labor patterns between different kinds of projects of similar average size are relatively small and exhibit, from one size group to another, a considerable lack of uniformity. In the $1 to $49,999 group, sewers and Diesel and steam engine plants appear to reach employment peaks and the stage where 90 percent man-hours have been worked sooner than other types; however, the average contract size of the engine plants is only two-thirds that of sewers, whereas the average size of the sewer projects is well above the median. On the other hand, buildings and highway construction projects appear to lag behind, despite the low average size of the highway projects. The average deviation from the group median time for all projects is 0.9 months less time for sewers, 0.7 months less for engine plants, 0.7 months more for highway construction, and 0.9 months more for buildings. Highway bridges, and pumping and filtration plants follow the median closely.

In the next size group, $50,000 to $99,999, the project types are yet more compactly bunched together, particularly if the average contract sizes are taken into consideration. The only outstanding exception is city street paving which, although its sample has a large average contract size, nevertheless has an average deviation of 1.3 months less than the median and reaches the employment peak and 90 percent completion substantially ahead of the other project types. Sewage disposal projects, on the other hand, tend to lag somewhat, having an average deviation of 0.8 months more than the median. Water main projects appear to move towards completion rapidly, but the small average size of $53,100 probably accounts for most or all of the deviation; and the reverse is true of the deviation of 1.7 months above the median time for Diesel and steam engine plants, which have a high average size. On the whole, the project types are very closely grouped, more so than in any of the other size classifications, and no significant variations are apparent, other than in the case of city street paving.

The differences in average contract size are more pronounced in the next size group, $100,000 to $499,999, where the highest average size is more than double the lowest. This is partly accounted for by the fact that there are no projects over $200,000 in the case of highway bridges, city street paving, and highway construction and paving. (The two highway projects over $200,000 have been treated separately.) Taking into account the large variations in average contract size the dispersion in this group also does not appear to be great. City street paving again reaches the employment peak and 90 percent man-hours worked most quickly, and has an average deviation of 2.1 months less than the median time. Highway construction projects are close behind with an average deviation of 1.8 months less than the median and actually get under way more speedily. At the other extreme, sewage disposal and treatment plants have an average deviation of 2.7 months more than the median and reach the employment peak some five months after highway construction projects. However, the average contract size of sewage disposal plants is $279,000, compared with $133,900 for highway construction and $144,400 for city street paving. The other project types are grouped within these limits and largely follow the order of their average contract size. Also included in this group are several miscellaneous project types for which a sample of three or more projects is not available. Of these, it will be noted that the two highway construction projects over $200,000 show a very rapid rise to employment peak and 90 percent man-hours worked. This is a continuation of the tendency which has appeared in the two previous groups for highway construction to show a smaller increase in its time requirements with

PECENTAGE OF TOTAL ONSITE MAN-HOURS PROVIDED MONTHLY AND CUMULATIVELY BY MONTHS, FOR DIFFERENT PROJECT TYPES

FIG. 37–SIZE GROUP: $500,000–999,999



increasing size than other classes of construction.[17] The two heavy bridges and the two hydroelectric plants have a labor pattern similar to water mains and buildings, although somewhat slower in reaching 90 percent completion, and their average contract sizes run well above the median. The flood control project lags far behind the others in this group.

In the $500,000 to $999,999 group, only the building sample is of sufficient size to be combined and treated as representative of this size group. However, the man-hour distribution of certain miscellaneous projects is plotted with that of buildings. The two pumping and filtration plants, the hydroelectric plant, and the sewage disposal plant have employment peaks and reach 90 percent completion well ahead of buildings, while the flood control project and, to a lesser extent, the two highway bridges lag behind.

In the group over $1,000,000 there are size combinations for buildings, heavy bridges, and low-cost housing. Of these, the first two have nearly identical patterns, whereas that of low-cost housing lags around 5 months behind until 80 percent completion is reached. However, the average contract cost of the low-cost housing sample is $5,000,000, compared with $1,471,000 for heavy bridges and $2,162,000 for buildings. Among the miscellaneous projects the outstanding patterns are those of the one sewer project, which has an average deviation of 7 months less than the median time, and of a hydroelectric plant, the New York Midtown Tunnel, and the Triborough Bridge, all of which required from 3½ to 5 years for completion. The largest project of the entire sample was the Pennsylvania Railroad electrification. This proceeded rapidly to a high level of employment and showed a sustained volume of man-hours without marked peaks.

MONTHS REQUIRED TO WORK 30, 60, AND 90 PERCENT OF TOTAL ONSITE PROJECT MAN-HOURS
BY PROJECT TYPES AND AVERAGE CONTRACT SIZES

FIGURE 39

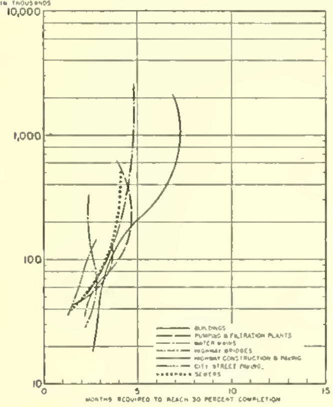


FIGURE 40

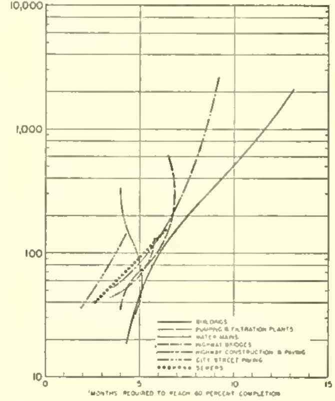
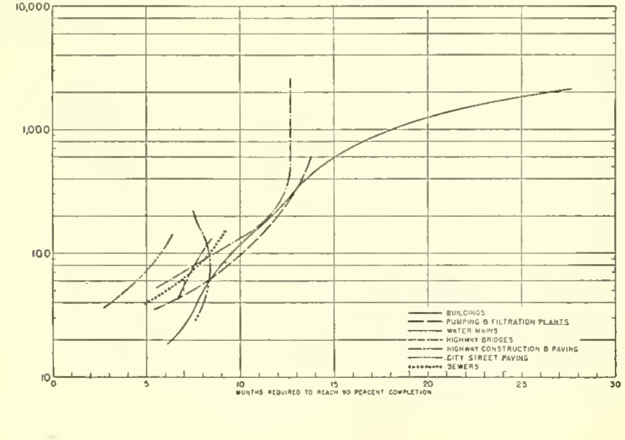


FIGURE 41



Because of the absence, relatively at least, of any uniform and well-defined relationship among the labor patterns of the various project types, it is difficult to form a clear-cut picture of that relationship. It will be noted that the relationship takes three forms: First, the timing and the level of the employment peaks; second, the months required to reach completion; and third, the volume of on-site man-hours provided per dollar of contract cost. On the basis of the small sample analysed above, some general conclusions can be drawn.

First, with respect to the timing and level of the employment peaks in the different size groups, it appears that the sewage disposal plants and building peaks tend to be low, prolonged, and to lag several months behind the others. On the other hand, the city street and highway construction peaks tend to be high, short, and to occur in the first 2 or 3 months of construction. The other labor patterns tend to fall between these two limits without much uniformity from one size group to another. The sample of projects over $1,000,000 is too small to justify drawing any conclusion as to the relationship of the various project types. It is clear that the size of the project tends to be much more significant in the determination of its labor pattern than the project type.

A comparison of the months required for different project types to reach specific stages of completion (in terms of man-hours) is made difficult by the large variations in the average contract sizes within the same size grouping. If a large sample were available, this difficulty could be avoided by the use of curves relating various contract sizes of each project type to the months required to reach a specific stage of completion. This has been done for seven project types for stages of 30, 60, and 90 percent completion in figures 39 to 41. Although the present sample is too inadequate to warrant much confidence in the accuracy of the curves for purposes of generalization, the figures nevertheless serve to summarize the relationship, as it appears in the sample, between the project types for which samples in several size groups are available. The figures clearly demonstrate the general similarity in the time requirements of the varous types up to contract sizes of around $150,000, especially those between

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[17] The preceding section measuring the elapsed time from start to completion (p. 89) has also indicated that this is the case.

TABLE 17.—*Cost per on-site man-hour, for various project types and size groups*

[In dollars]

	Under $50,000	$50,000 to $99,999	$100,000 to $499,999	Over $1,000,000	Average deviation from median
Highway construction and paving	1.95	2.33	2.07		−0.60
Sewage disposal and treatment plants		2.37	2.47		−.46
Sewers	1.66	2.84	2.40		−.42
Grade-crossing elimination		2.90	2.31		−.28
Highway bridges	2.39	2.14	3.10		−.17
Heavy bridges				3.04	−.01
Low-cost housing				3.05	.00
City street paving		2.34	3.68		+.13
Pumping and filtration plants	2.62	2.88	3.44		+.26
Buildings	2.79	2.66	3.25	3.93	+.36
Water mains		3.02	3.47		+.37

$60,000 and $120,000. The outstanding exception is city street paving which requires substantially less time than the others. For contract sizes over $150,000 the sample becomes increasingly smaller, and the project curves tend to spread out in diverse directions. Large highway construction projects require no more, if as much, time to reach the various stages of completion than do the smaller projects. On the other hand, as the size of a building project increases, its time requirements increase substantially also.

Although the differences in on-site man-hours provided per dollar of contract cost by different project types and sizes are considerable, caution is urged in interpreting these variations, for reasons explained above.[18] However, two tendencies seem to be evident: First, excavation and similar construction techniques tend to provide more on-site man-hours than other operations, and, second, small projects tend to involve more on-site man-hours than large projects. Table 17 gives the cost per on-site man-hour for different project types and size groups (where samples of three or more projects are available), together with the median cost for each size group and the average deviation from the median for each project type. Highway construction, sewers, and sewage disposal plants run on the average well below the median in man-hour cost, whereas water mains and buildings substantially exceed the median.

Patterns of Wage Earners, Pay Rolls, and Material Orders

In addition to the monthly distribution of on-site man-hours, the Bureau of Labor Statistics also compiled for the sample of 249 projects the monthly distribution of wage earners, payrolls, and material orders. These three break-downs have not been presented heretofore in this chapter because it was found that the monthly distributions follow closely those of man-hours. It may be of some interest, however, to show a comparison of the four distributions for the aggregate sample broken down into size groups. This is done in figures 42 to 46. A sufficiently large number of cases is included in each size group, in most instances, to submerge the aberrations of individual projects. However, a few projects in the larger size groups distort the patterns to a marked degree. For example, for the group over $1,000,000, the New York Midtown Tunnel construction period extends the time required for completion from 42 to 59 months.

The similarity between the three labor patterns is quite evident. At 50 percent of completion for all size groups, the greatest spread between the most retarded and the most advanced of the three distributions is barely more than one month. At 90 percent of completion the spread never exceeds a month, except in the case of the size group over $1,000,000 where the spread is 2 months. One interesting fact which may be noted here is the lag which occurs on projects in all size groups from 90 percent completion to full completion. This lag ranges from 6 months in the smallest size group to almost 2½ years in the largest group.

The data on material orders placed are not as accurate for purposes of distributions by months as the data on man-hours, wage earners, and payrolls. This arises from the fact that contractors reporting to the Bureau of Labor Statistics tend in some cases to delay tabulations of material orders until the later stages of the project, thus bunching the data. This may account for the somewhat erratic course of material orders in the larger size groups where the sample is small. In the small and medium size groups the patterns of material orders tend either to be identical with or to precede somewhat the labor patterns.

For the most part, however, the patterns of man-hours, wage earners, payrolls, and material orders resemble each other closely, and reach their peaks and various stages of completion within each size group almost simultaneously.

The Composition of a Public Works Program

It is not possible in any short space to summarize the material presented in this chapter. So far as it is useful in setting up or forecasting the employment and income-creating behavior of a public works program, it will have to be applied in each individual case, and in this connection the possibility of error resulting from the smallness of the present sample should be kept constantly in mind. It may be useful, nonetheless, to bring together at this point certain general observations on the behavior of differently composed public works programs.

In the first place, with a public works agency in existence, with an "active" portfolio of projects awaiting allotments, and with procedures and legal limitations as at present, about four months will elapse between legislative authorization of increases in non-Federal works activity and actual construction work on a substantial proportion of the projects. About 2½ months will elapse in the case of Federal construction. With exceptions (and some range between the time when, say, 25 percent and 90 percent of the projects are under construction) the composition of the program at this stage is not of great importance, provided that it is being launched in the summer. Numerous small projects proceed as rapidly to construction as fewer large

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[18] See pp. 95,100.

PERCENTAGE OF TOTAL ONSITE MAN-HOURS WORKED, WAGE EARNERS EMPLOYED, PAYROLL DISBURSEMENTS MADE, AND MATERIAL ORDERS PLACED, MONTHLY AND CUMULATIVELY BY MONTHS

FIG. 42—ALL TYPES, SIZE GROUPS: $1–49,999

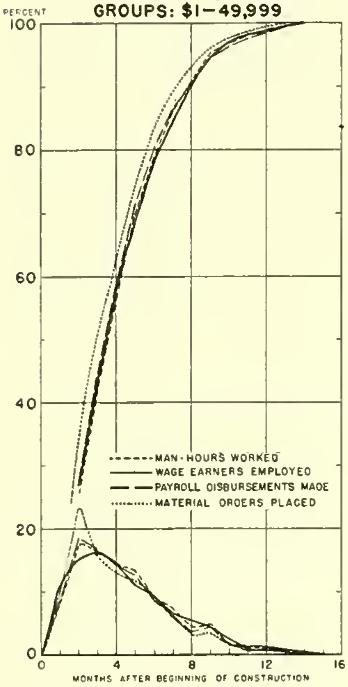


FIG. 43— ALL TYPES, SIZE GROUPS: $50,000–99,999

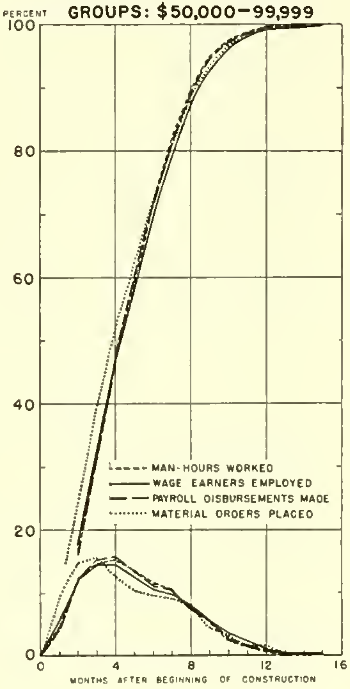


FIG. 44—ALL TYPES, SIZE GROUPS: $100,000–499,999

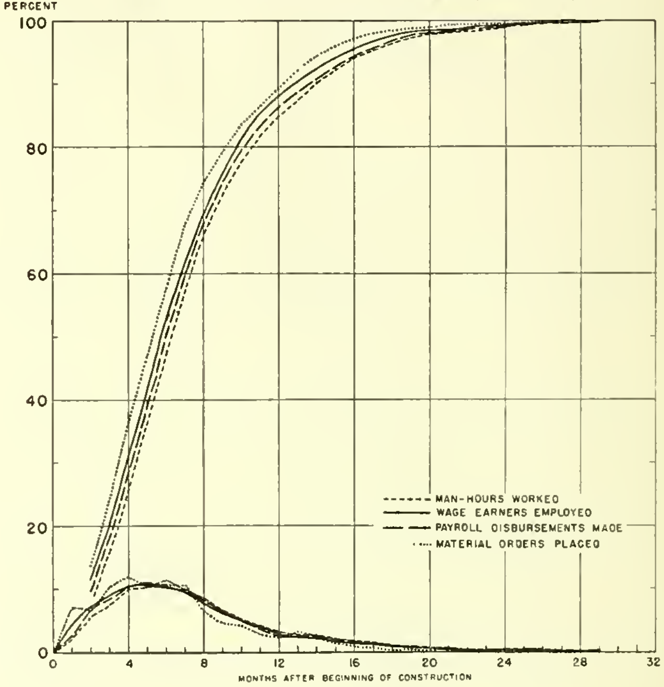
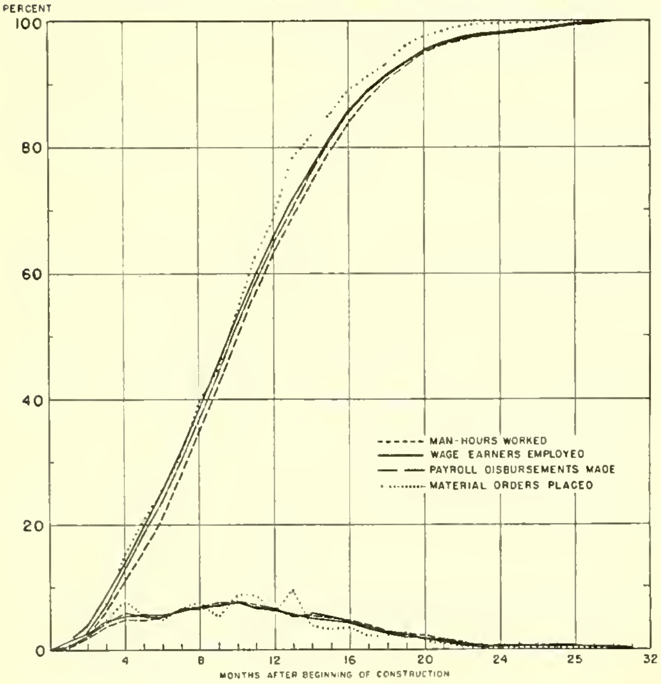
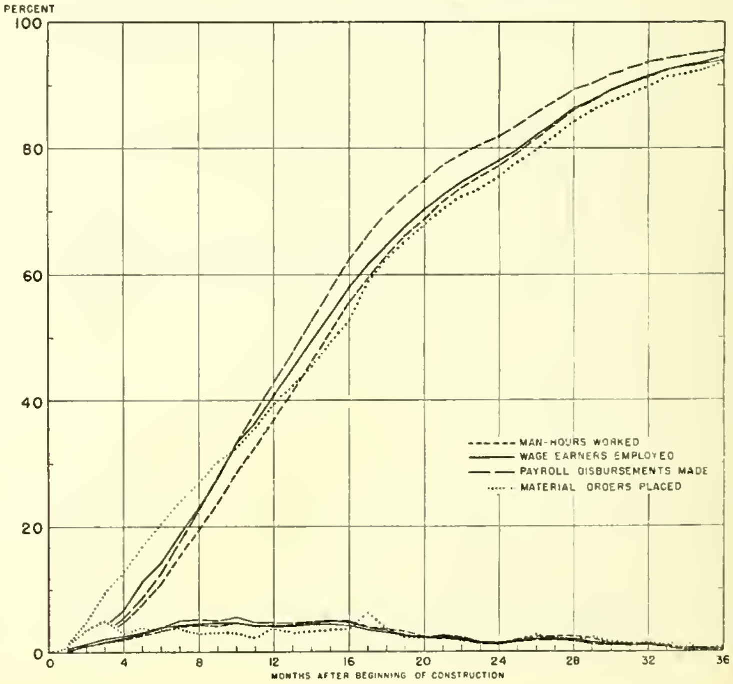


FIG. 45—ALL TYPES, SIZE GROUPS: $500,000–999,999



SOURCE BUREAU OF LABOR STATISTICS

FIG. 46—ALL TYPES, SIZE GROUPS: $1,000,000 OR OVER



ones; roads and highways proceed more rapidly than buildings to the contract stage, and a shorter time elapses from the awarding of contracts to the beginning of construction. However, if the work is being expanded as winter approaches, long delays must be expected for highway projects and paving and city street construction. Building projects, on the other hand, seem less likely to be delayed than the average. There is some evidence from the study that if work is being expanded in the autumn, delay and consequent seasonality of employment might be reduced somewhat by pressing building projects over, for example, street and road construction.

Once construction is under way its composition is of first importance in determining its employment behavior and likewise the volume of orders which accompany it. If the employment and business response is desired quickly, projects should be selected which proceed to peak employment quickly. To get maximum response within a period of 2 to 4 months from beginning of construction, the projects should be, in the main, $50,000 or less in cost. If the cost does not exceed this amount, it does not matter greatly what kind of construction is undertaken. Larger road and paving projects can be added without markedly increasing the time required to reach peak employment. A program of small projects will also yield the greatest amount of on-site (and probably total) employment. The amount of on-site employment can be still further increased by weighting the construction with projects requiring digging, excavation, and grading rather than erection of structures. This will also have the effect of decreasing slightly the time required to reach maximum employment. Once maximum employment is reached on a program made up of small projects as just outlined, diminishing employment will begin and proceed as rapidly as the initial increase. In other words, except in the case of highway projects, a quick-starting program which is not maintained with new projects has a corresponding lack of durability.

Circumstances might arise for which expansion of public works at the most rapid possible rate would be desirable. It seems hardly likely, however, that a program would ever be selected entirely on such grounds. Even if a rapid beginning is desired, durability of employment is also likely to be important. Under such circumstances the first emphasis would still be on small projects for their early effect, while the large projects would begin to provide employment and orders as the smaller ones tapered off. First emphasis for the beginning would again be on projects costing $50,000 or possibly $100,000 as a maximum, with a considerable proportion of excavation projects of this size, and the inclusion, also, of road construction of whatever scale. Initial pressure for getting larger projects under way is less important since the early effect in all cases will be small. Their importance appears later in supporting the level reached by the smaller projects and preventing the decline which would otherwise occur upon their completion. The analysis in preceding sections gives some clue as to the combinations of projects through time which might be expected to yield any given result.

In a program of continuing investment in public works, issues of flexibility are, as elsewhere shown, much less important. However, the wide differences in behavior between different classes of construction do retain significance. Assuming the necessary administrative power exists, small projects in the program make it possible to slow down the rate of activity, should occasion arise, without actual interruption of work on any single project. Likewise, an expansion of public works activity to accord with a slump in private employment and business activity would have to be brought about with smaller projects of the more flexible types. In other words, flexibility in a continuing program requires inclusion of a large number of projects costing under $100,000 and preferably under $50,000. If such projects are included in the program it can always be slowed down promptly by allowing them to go to completion without beginning new work. Likewise, a reservoir of such projects must be regarded as the only practical device by which a program can be expanded to accord with rapid swings in employment. Little can be done, in this respect, with heavy, large-scale construction.

Forecasting Public Works Employment

With appropriate qualifications, the preceding analysis also bears on the problem of forecasting the employment and income-creating behavior of a public works program. The size and character of public works projects getting under way at any time is known. Assuming that valid generalizations can be made from figures 14 to 41, an appropriate curve or labor pattern may be projected forward for each project as construction begins, or, with proper allowance for seasonal factors, when the contracts are awarded. The summation of the ordinates of the curves for any day in the future should give an approximate estimate of the employment based on past experience. Somewhat more roughly, as indicated in the immediately preceding section, it is also possible to project the volume of material orders to be expected.

In order to illustrate a technique for projecting the behavior of a public works program, a sample forecast has been drawn up, based on a hypothetical $20,000,000 program. It is assumed that all the contract awards are made within a 3-month period in the spring, on April 1, May 1, or June 1. The program comprises 117 projects, heavily weighted with buildings (51 projects) and highways (23 projects), the two types for which the sample presented above is most nearly adequate. The sizes of the projects were chosen at random. The $1 to $49,999 size group comprises 56 projects totaling $1,540,000; the $50,000 to $99,999 group, 30 projects totaling $2,035,000; the $100,000 to $499,999 group, 28 projects valued at $4,925,000; and the over $1,000,000 group, 3 projects totaling $11,500,000. The dates of contract awards were likewise selected haphazardly, $4,680,000 being awarded on April 1, $7,070,000 on May 1, and $8,250,000 on June 1.

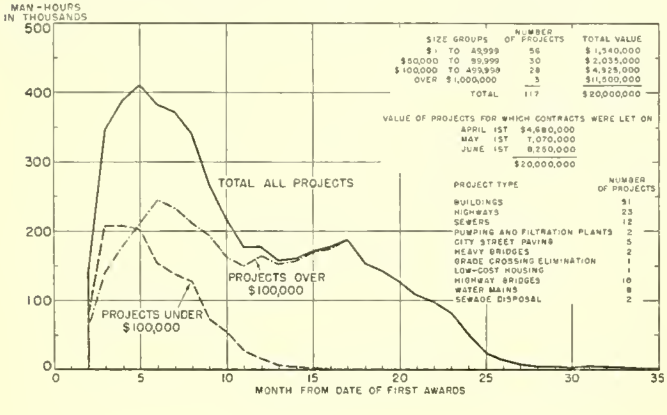
The assumptions made in this sample forecast should be carefully noted. It has been drawn up merely to illustrate how the material in this chapter, as it is more fully developed, can be used in the future planning of public works. The present sample of projects is inadequate and data are missing on the causes and extent of stoppages in construction, and on the differentials in labor patterns resulting from the starting of construction in different months of the year. It should be noted also that all of the sample program was started within a period from April 1 to June 1, while in practice projects would be getting underway in varying numbers over a longer period. This means that a large proportion of the projects were proceeding to completion at about the same time, and accounts for some of the rapid falling off of employment.

The aggregate labor pattern of the program, and the patterns of the projects over $100,000 and under $100,000, are shown in table 18 and figure 47. From the previous analyses of this chapter, we know that, for contracts awarded in the spring, construction gets under way, on the average, approximately 1 month after the date of contract award. Consequently, the labor patterns start during the second month after the first series of contracts were awarded on April 1. Thereafter it is assumed that the labor pattern of each project follows that of its size and type, as presented in previous sections of this chapter.

The 1-month period before the start of construction does not, of course, constitute the full lag involved in a public works program, but only that after contracts have been awarded. Previous to that time there are also lags involved in the processes of legislative authorization, allotment, and contract awarding. The time requirements of these various stages have been discussed in detail in earlier sections of this chapter.

FIG 47

MONTHLY DISTRIBUTION OF TOTAL ONSITE MAN-HOURS PROVIDED BY A HYPOTHETICAL $20,000,000 PUBLIC WORKS PROGRAM, ALL CONTRACT AWARDS BEING MADE WITHIN A THREE-MONTH PERIOD



It will be observed in table 18 and figure 47 that the program rises rapidly to the monthly peak of 414,000 man-hours worked in the fifth month. Thereafter it declines almost as rapidly to 178,000 man-hours in the eleventh month. Leveling off to the seventeenth month, it begins a slow decline to practical completion around the thirtieth month. The man-hour patterns of the projects over and under $100,000 illustrate the effect of size on the labor pattern. Thus, the small projects reach their man-hour peak in the third month (the second month of actual construction) and after the fifth month decline rather sharply to virtual completion around the thirteenth month. The large projects, on the other hand, reach their peak 3 months later, in the sixth month (the fifth month of actual construction), and continue at a relatively high level until the seventeenth month, or 4 months after the small projects are practically complete. The bulk of the employment provided by the small projects occurs in the third to eighth months, that provided by the large projects in the fourth to twentieth months.

In practice, no forecast of the employment on a public works program can be made on a strictly mechanical basis. However, it is believed that the technique just outlined provides a good beginning on the problem of predetermining the behavior of such employment. Based on a larger sample of past construction than the one available here, it should be reasonably accurate.

TABLE 18.—*Composition of a hypothetical $20,000,000 public works program by project type and size group*

[Number of projects]

	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	Over $1,000,000	Total projects	Total value
Buildings	33	8	10		51	$3,420,000
Highway construction	12	6	5		23	1,585,000
Sewers	6	4	2		12	760,000
Pumping and filtration plants		1	1		2	190,000
City street paving		3	2		5	560,000
Heavy bridges				2	2	6,500,000
Grade-crossing elimination			1		1	150,000
Low-cost housing				1	1	5,000,000
Highway bridges	5	2	3		10	700,000
Water mains		5	3		8	900,000
Sewage disposal		1	1		2	235,000
Total projects	56	30	28	3	117	
Total value	$1,540,000	$2,035,000	$4,925,000	$11,500,000		$20,000,000

GENERAL SUMMARY[1]

1. The problem of Federal public-works policy in recent years has become, in large part, the problem of relating procedures in this field to the task of combining idle men and idle resources for useful public construction. The present study is concerned with the experience of recent years on this problem. Attention is centered largely on the public-works policy of the Federal Government, although much of this policy in recent years has involved cooperation with State and local units of government.

A description and analysis of recent public works experience is no easy task. A study of the policies, procedures, and consequences of this activity is rendered difficult for several reasons. In the first place, the major public works programs were established under the pressure of an unemployment crisis. The presence of mass unemployment required the rapid establishment of agencies and policies designed to meet the emergency. Financial difficulties of State and local governments resulted in a series of complex financial arrangements between the various levels of government. Policies and procedures changed as new experience was gained and new legislation enacted. The distinction between "normal" public works activities and "emergency" public works activities is also a source of difficulty.

The analysis of public works activities is further complicated by the need for distinguishing between "public works" and "work relief" construction. In this report, attention is directed, in the main, toward public works as distinct from work relief. The lines of separation are not sharp, but the broad differences can be marked off. The main purpose of work relief is to provide the maximum of direct, or on-site, employment to needy unemployed; usually this work is done by force account and not by contract. Public works place less emphasis on on-site employment; much of the expenditure is for materials which provides a considerable volume of off-site employment; a considerable volume of heavy construction is undertaken, and, typically, the work is done under contract. These differences are not too sharply defined, but the broad purposes of public works and work relief, as well as the different cost ratios and procedures, make such a distinction necessary. The main interest of this report centers on public works. Work relief and the relation between work relief and public works are touched on only incidentally.

2. In using public expenditure as a supplement to private investment for the purpose of employing idle men and idle capital, the experience of the United States in recent years has been in nowise unique. The same policy has been followed by all other important western countries. The unique aspect of the American experience is that this country stressed objects of peacetime utility rather than primarily armaments.

3. In an effort to make use of unemployed resources, public works occupy a prominent but by no means exclusive place. Public works are inherently neither more nor less useful than the other services rendered by the Government. They do have the special quality of requiring a relatively large present (i. e. construction) expenditure and a relatively small continuing (i. e. maintenance) expenditure, which means that employment for the provision of a continuing service in the future is concentrated very largely in the present.

4. The views of the unemployment problem in relation to public employment, including employment on public works, are in a transitional stage. We can no longer be sure that unemployment is a cyclical problem appearing and disappearing as the economy alternates between depression and prosperity. Unemployment may be an enduring problem arising from a continued diminished volume of private investment. The cyclical view of unemployment envisaged a counter-cyclical or "compensatory" expansion of public employment to offset the decline of private employment, and a contraction of public employment as private employment revived. If we reckon with the possibility of a continuing volume of unemployment, then the question of a long-term expansion of the volume of public employment must at least be faced. This possibility has been taken under consideration in the present study.

5. Given a policy of absorbing a part of the unemployed on public works construction, the responsibility of the Federal Government is greater than that of States and localities. The Federal Government has advantages in its borrowing power and in its fiscal arrangements which are necessarily more or less peculiar to the central government. For these reasons we must in all probability look to the Federal Government for continuing leadership in any policy of using public works as a supplement and support to private business activity and employment.

6. It has long been supposed that, because of the durability of public works, there is some special justification for financing public works expenditure by bor-

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[1] For purposes of brevity many qualifications, some of them of importance, have been omitted from this statement.

rowing. So far as the Federal Government is concerned this justification is dubious. The governing consideration is the fiscal policy at the time, that is, the policy of the Government with respect to taxation and borrowing, which depends on many factors.[2] For States and localities the same principle holds, although for the smaller units of Government public works expenditure, unlike other outlays, tends to be an extraordinary item in the budget for any given year. In this case a special connection between public works expenditure and public borrowing does exist from a practical point of view.

7. In the selection among specific kinds of public works construction, the basic criterion continues to be the usefulness or community value of the construction. No considerations growing out of the use of ordinary public works for purposes of raising the general level of employment and income are in serious conflict with this basic requirement. In a PWA type program, where a choice must be made among different projects sponsored by different communities, the measurement of usefulness is a difficult and probably somewhat arbitrary matter. No attempt has been made in this study to pass upon the criteria of usefulness which have been or might be employed. The point is that usefulness or community value, by some determination, should be the primary consideration in selection of public works.

8. Within the range of useful public works certain other criteria bear upon the selection of projects under present conditions. There is a considerable range in the total man-hours provided per dollar of cost as between different kinds of projects. Under certain circumstances or in areas where the problem of unemployment is especially critical, it would appear justifiable to emphasize those projects where the yield of on-site employment is large. A regional distribution of construction projects is also necessary. So far as public works (excluding work relief) are concerned, this has been better achieved through federally aided public works than through direct Federal construction. It is also possible that non-Federal construction, i. e., State and local public works, is the type of public construction where need is most pressing. More attention might be given in the future than has been given in the past to types of public works which are likely to bring additional private investment in their wake.

In a well-ordered program of public works less emphasis than hitherto would be placed on projects which have, as their chief recommendation, the possibility of being started quickly. When the volume of unemployment is large, there seems to be little or no reason for attempting to adjust public works construction (excluding work relief) to available skills in the labor force or to plant capacity in the material supply industries; the amount of "play" between requirements and resources here seems sufficiently great that this can be neglected.

Construction Expenditure and Employment Since 1933

9. It has been suggested that public works occupy a "prominent but by no means exclusive place" in the task of making effective use of idle men and resources. The scale of this possible contribution can, of course, only be measured by reference to past experience. Several measures—the effect on the construction industry, on the industries supplying construction materials, on employment at and away from the site of construction, and on employment in relation to unemployment—are necessary to a full view of the effect of public works activity in recent years.

10. Although, in the years from 1933 to 1938, the total volume of new construction expenditure, including work relief construction, was more than doubled, in the best year (1938) this total was only 60 percent of the predepression level. Excluding work relief, the total reached only 49 percent in the best year. Consequently, since 1930 our economy has been without one of the principal supports for the relatively high level of income and business activity which existed in the 1920's.

11. Such recovery as has occurred in construction, however, has been due in large part to the manifold increase in Federal and federally financed construction activities, which were carried on from PWA funds, regular Federal appropriations, and work relief appropriations. The total Federal construction expenditures averaged $1,630,000,000 annually from 1933 to 1938, compared with $188,000,000 from 1925 to 1929; this represented an increase between the two periods from less than 2 percent to 35 percent of all construction expenditures. Excluding work relief construction, Federal construction expenditure averaged $843,000,000 from 1933 to 1938. The dollar volume of State and local construction expenditure has shown no significant increase from the greatly depleted level of 1933 and, consequently, has acted as an important offset to the increase in Federal construction expenditure.

12. Material orders on Federal and federally aided construction (including both loans and grants and on work relief construction) have proved an important sustaining factor in the activity of a number of specific construction supply industries. The most notable of these are the cement, cast-iron pipe and fittings, sand and gravel, crushed stone, and structural steel industries. In these industries orders on projects financed wholly or partially from Federal funds have been the equivalent of from 20 to 60 percent of the total pro-

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[2] A policy of public works employment does have a special significance for the fiscal policy and the public debt. The central issues here are discussed in appendix A.

duction of the years 1934–38. While the volume of these orders has by no means taxed the capacity of the industries in question and consequently has probably not induced much new investment, nevertheless it has undoubtedly been an important factor in expenditures for the maintenance and improvement of existing capital equipment.

13. As a corollary to the sharp decline in private, State, and local construction, construction employment under these auspices has likewise fallen off substantially since predepression years. Employment on direct Federal construction, on the other hand, was in 1934–38 six times that of predepression years. Employment on projects financed jointly from State and local and Federal funds also increased sixfold. Furthermore, Federal work relief construction has provided jobs for a large number of workers on the site of construction, and if these are included, the aggregate number of men employed on the site of construction in 1936, 1937, and 1938 actually exceeded, by some 20 percent, on-site construction employment from 1925 to 1929. This was not true, of course, with respect to off-site employment.

14. Estimates have been made of the volume of off-site employment created by the various Federal construction programs in relation to the volume of on-site employment. These estimates would indicate that the ratio of off-site man-hours (employment on the manufacture and transportation of materials and in project administration) to on-site man-hours was 1.0 for PWA Federal projects, 2.0 for PWA non-Federal projects, 1.0 for regular Federal projects, 0.6 for projects conducted by Federal departments under the works program, and 0.16 for WPA projects. It is thought that these estimates represent more nearly the maximum than average ratios. The variations in the over-all ratios of the several programs, excepting work relief, result primarily from differences of project composition. For similar types of projects the off-site ratios are practically identical.

15. Combining estimated off-site and on-site employment on regular Federal, RFC, and PWA projects, and Federal projects under the works program, it was found that the total employment afforded in the period 1934–38 averaged about 1,200,000 men. This was some 13–15 percent of estimated average unemployment during this period, workers on work-relief construction being excluded from the unemployment figures. In addition, work-relief construction provided employment for an average of 1,640,000 men, which was equivalent to about 18–21 percent of average total unemployment during the period. These calculations do not include "secondary" employment from the spending and respending of the increased incomes received by those engaged on public works projects or in supplying materials.

16. An analysis of the regional distribution of employment on PWA and regular Federal projects indicates that the range of variation between regions, on the basis of both regional population and unemployment, is much greater for Federal than for non-Federal projects. Over the 6-year period as a whole the regional distribution of non-Federal projects has been relatively even, the percentage which employment represented of total unemployment (or population) having been only one-half again as great in the region with the highest proportion as compared with that with the lowest proportion.

17. The average cost per man-hour, including both estimated off-site and on-site employment, was estimated to be 88 cents for PWA Federal projects, $1.12 for PWA non-Federal projects, 91 cents for regular Federal projects, and 55 cents for WPA projects. This disparity in cost was found to have resulted in considerable measure from the different proportion of skilled labor employed and the different levels of on-site wages paid on the several types of construction. These varying wage levels, in turn, result in large part from the different proportions of skills used on the several programs. These calculations of the cost of providing an hour of employment give no indication of the comparative costs of obtaining a given completed structure under the different auspices. This question has not been investigated in the present study.

18. The investigation of the effects of Federal public works activities, excluding work relief, on business and employment during the last 6 years shows that the scale of such activity was not sufficient to maintain the total volume of construction and construction employment at a level approaching that of the predepression years. Including employment on work relief construction, total on-site construction employment was substantially increased over the 1920's, but this did not hold true for off-site employment. In terms of its effect on national income and total business activity, the claims for Federal public works activity must accordingly be modest. On the other hand, the task of getting full employment and a high national income is a complex one. Just as it is important to recognize that public works construction on the modest scale of recent years did not accomplish the entire task, so it is important to recognize that the reductions in unemployment and increases in business activity which have been realized are important achievements.

Price and Cost Relationships

19. The prices of building materials in the period 1926–38 have remained well above wholesale prices generally, relative to the year 1926, and in 1938 the index of the former was about 12 percent above the

index of the latter. Wage rates in the construction industry have followed closely the wage rates in all industries generally, but both have increased substantially since 1932, and in 1938 were at levels exceeding those of the predepression years.

20. A comparison of the movements of construction costs and of the volumes of private, State and local, and Federal construction activity appear to indicate the possibility that the Federal public works programs have had a disproportionate effect on prices and costs in critical periods, notably 1933–34, 1936, and 1938. This may have arisen as a result of the timing and nature of the public works program, which have led to the bunching of bid invitations and contract awards amid much attendant publicity. It is believed that a more orderly procedure in authorizing public works construction and reduced haste in getting "programs" under way, as elsewhere suggested, would reduce this effect.

21. A comparison of the movements in construction costs and the prices of the elements entering into construction costs would seem to indicate that the former have increased since 1933 much more than the contract cost of comparable construction projects. The prices of construction materials and labor as represented by the *Engineering News-Record* index were, in 1938, some 13 percent above the 1926 level; whereas contract construction costs, as represented by the American Appraisal Co. and Interstate Commerce Commission indexes, were an equivalent amount below. Further investigation indicates that the increase in construction prices was due largely to the rapid rise in wage rates. A part of the gap between the *Engineering News-Record* index and the other indexes has resulted from the substantially greater weight given by the former to the labor factor, but a part also may be taken to indicate increasing labor efficiency in the construction industry. Under the circumstances there may perhaps be no grave cause for concern over the longer run movement in construction materials prices. However, these are matters upon which, in the future, a close current check should be maintained by the public works agency.

Administration, Timing, and Flexibility

22. The problem of timing public works activity, under modern conditions, is not one of increasing or decreasing the volume of employment to accord promptly with short-run changes in the level of employment and to utilize all unemployed on public works is not a practical or necessary goal. To the extent that fine adjustments between work and unemployment must be made, work relief organization is better adjusted to the task. The objective in timing public works is expansion or contraction to accord with more important and more persistent movements in economic activity and employment.

23. Public works timing in recent years has not approached the above-mentioned ideal. As elsewhere noted, unaided State and local public works have fallen off even from the low level of 1933. Federal or federally aided public works have been administered in two parts. Little over-all thought has been given to the timing of that part which we call "regular" public works, which are provided for in regular departmental supply bills. In the Federal and non-Federal PWA programs emphasis has been not on any particular time pattern so much as on speed in getting each individual program under way.

24. If public works construction is to be used as one of the offsets to unemployment, the questions of timely provision for public works must rank in importance with the determination of the character and volume of the works to be built. As a minimum program it is suggested:

(*a*) That the major public construction programs to be undertaken or aided by the Federal Government be considered in a single appropriation bill;

(*b*) That consideration of the appropriation bill in light of projected economic conditions be a first order of business upon the reassembling of Congress each January, with provision for subsequent additions or amendments, and also for executive curtailment should conditions require;

(*c*) That, for the non-Federal public works grants, applications be received at all times as a permanent policy and provision be made for keeping an "active" reservoir of projects to be given Federal aid as occasion justifies. Certain problems which arise in connection with this proposal are outlined in the report.

25. In past years, in the PWA programs, special emphasis has been placed on quick-starting, and to some extent, for this reason, quickly terminating projects. It is believed that timely legislative provision would make it possible to avoid this emphasis. It is also important that the probable construction and employment pattern of different classes of public works be known in advance. If these are known there is some possibility that a construction program as a whole can be so arranged as to achieve within limits the employment and income-creating effect when and as desired, or, as a minimum, such advance knowledge will make it possible to predetermine the employment and business-creating effect of a given volume of public works.

26. The present study has analysed in some detail the employment and general construction pattern of different classes of public works undertaken in the past. This material does not permit of a short summary, but on the basis of past experience the following observations can be made:

(*a*) Following legislative authorization of a program of public works construction under PWA procedures, it can be anticipated that about 2½ months will elapse before contracts can be awarded on a substantial proportion of the Federal projects and 3 to 4 months for non-Federal construction. This is the time required to prepare plans and specifications, advertise and receive bids, and, in the case of non-Federal construction, to complete negotiations between the Federal Government and the States and localities, and permit the latter, if necessary, to hold bond elections. In individual cases this period may, of course, be much less or much longer. Differences in the size and character of the construction do not greatly alter the time required. Further shortening of this period of time will require a fairly drastic reordering of present procedures. Something, especially in Federal construction, could be done were provision made for advance preparation of construction plans.

(*b*) In past PWA experience there has been a considerable lapse of time between the awarding of contracts and the beginning of actual construction. This has been particularly great—on the average between 1 and 2 months—when the contract was awarded in the winter months. Past programs have been so timed that much of the construction encountered this delay.

(*c*) After construction starts, the size of the project is of controlling importance in determining the time to completion, the time required to provide peak employment, and the period within which the bulk of the employment and purchases of material are provided. Small projects, especially those costing $100,000 or less, proceed much more rapidly in all cases than large projects. Highway and road construction are somewhat of an exception. Large highway projects proceed to peak employment about as rapidly as small ones.

(*d*) The type of construction is of much less importance than the size of the job. Among projects of a substantially similar size, those involving excavation, grading, or other relatively simple construction techniques proceed more rapidly to peak employment than buildings, bridges, or other more complex construction.

(*e*) Small projects provide more man-hours of employment on the site of the construction per dollar of expenditure than large projects.

(*f*) The analysis of construction and employment behavior on different sizes and classes of projects has been carried through in terms of the man-hours of employment provided in different periods of elapsed time after the beginning of construction. In general, the pattern of employment and payrolls and also, on more limited evidence, the pattern of material orders placed conform in a general way to the pattern of man-hours worked.

27. The analysis of patterns of employment and material orders on different sizes and classes of construction provides the basis for projecting the construction behavior of future programs of public works construction. A technique for making such a forecast has been set up in the present study and it has been applied to a sample program. More complete coverage of past construction experience is needed before these forecasts can be considered entirely reliable.

28. Obviously, it is impossible to reach any conclusions as to what the size of a desirable public works program in the future should be. That depends on many things, among which the behavior of private investment and employment, and the claims of other public services in relation to the need for additional public construction are especially important. The basic principle itself of viewing public works as one of the offsets to unemployment and idle resources would appear, on the whole, to be justified by the experience since 1933; we recommend the continued consideration of the volume of both Federal and federally aided construction from this point of view.

APPENDIX A—THE FINANCIAL IMPLICATION OF PUBLIC WORKS EXPENDITURE

The upshot of the discussion in Chapter I is that Federal public works do not, by their inherent character, justify or require any particular form of financing. However, a broad policy of public expenditure to counteract unemployment does have a special fiscal significance. Insofar as public works construction is a part of such a policy, it shares the financial implications of the policy as a whole. Since it is a basic assumption of the present study that public works are being viewed as part of a larger program of public employment expansion, the financial implications of such a policy may be reviewed briefly.

The most warmly disputed question, and for this reason, if for no other, the most important question, is the effect of this approach to unemployment on the national debt and the long-run financial position of the country. The effect of a policy of public expenditure, including construction of public works, on the national debt depends on two things. It depends on the extent to which the tax structure can be adjusted to the particular requirements of this policy, and it depends also upon the unemployment situation which is being faced.

If the unemployment situation can be considered purely a cyclical or episodic problem, then a program of public expenditure (including expenditures for public works) designed to counteract this unemployment has no major financial consequences. Such a view has been prominent in the past. When private employment falls off, public expenditure is expanded and the Government finances this investment in the main by borrowing; some tax increases are perhaps desirable, but for financing the whole expenditure tax revenues would be inadequate, too slow, and possibly deflationary in their effect. It is assumed that in the next period of prosperity the Government investment is contracted, tax rates somewhat increased, and, with the enhanced revenues, the debt is amortized. Over the period of the cycle the budget is balanced.

The question has been raised whether it is possible to proceed on the theory that American business has a rhythmic oscillation from and to full employment. Even if it is possible to do so, the idea of an equally rhythmic creation and extinction of debt does not accord with the loose-jointed improvisation which is an intimate part of American political practice and public finance. As a practical matter, if we are committed to the idea of compensatory spending by the Government we should also at least be ready to accept, for considerable periods, the possibility of an increasing public debt.

If we face the prospect of continuing unemployment and a continuing need for publicly provided employment, we have even stronger likelihood of an increasing public debt. It will be necessary, vitally important in fact, that the tax structure be adjusted to this situation. Taxation will need to increase and it will have to be shifted from areas where its incidence is upon private spending and investment to where it absorbs, so far as may be practical, revenues which if untaxed would be unspent. It will take time to effect such changes, and increased tax revenues can only be a partial substitute for investment of borrowed funds. The public debt will therefore rise.

In considering the effect of this it is well to notice first of all our attitude toward a period of active private debt creation. It is a matter of experience that periods of active private debt creation have been periods of increasing national income. In fact, active private debt creation, i. e. financing of that part of new capital which is not provided by the sale of equities, has been taken as the sine qua non of good times. And there is some general evidence that periods of active private financing are periods when the burden of private debt actually diminishes. So long as the private debt increases, the total income of the country increases therewith by a sufficiently greater amount to decrease the burden of transfers between debtors and creditors. It is in periods when private debt is contracting, and income more than proportionately so, that the pressure of transfers on account of debt is increased.

The effect of public expenditure and debt creation parallels that of private investment and private debt creation in one major respect.[1] Active private financing means an addition to the funds which are spent and respent; and from the income so created, private companies can meet with greater ease higher interest charges on bonds and bank loans. Public financing, though we have usually seen it on a smaller scale, means the expenditure and reexpenditure of additional funds, and to the extent that profits and personal incomes are enhanced, tax payments even though larger are less burdensome.

Of course, the kinds of things in which the Government invests differ from those in which private enterprise invests. The Government's field is education, conservation of natural resources, health, housing, and living conditions, national defense, public works, research, and the like; private investment centers upon the more distinctly material equipment of the country—factories, farmsteads, mine equipment, steel mills, electrical generating plants, and so forth, as well as in durable consumer's goods. However, the importance of these differences should not be exaggerated. The reason that a single private enterprise can take an increased debt is that the increase in its material equipment, its factory, machinery, or the like, make it better able to support the transfers to its creditors. Industry as a whole, however, can only finance its transfers as the result of a steady flow of income accompanying a steady flow of investment. A part of public construction is self-liquidating where, as in the case of private investment, individual projects command the income to meet their own debt service. For the public debt as a whole, however, the transfer problem is the same as for private industry. The pressure of the debt on the tax base depends on whether there is a continued flow of borrowing, public or private, and whether, accordingly, incomes are maintained. In the case of both public and private debt the long-run burden is not a question of absolute magnitude but of the size of the flow of income from which debt service is drawn, and as the economic system is organized that income depends on a steady volume of borrowing and investment.

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[1] In practice, active private debt creation is regarded favorably, and public debt creation much less favorably. For this reason, and quite apart from the merits of the two situations, a given volume of private borrowing and investment may have a more pronounced stimulative effect than a like volume of public borrowing and expenditure.

A fair summary of the problem of growing public debt should, the foregoing analysis nothwithstanding, begin by emphasizing the unknowns. This is a new field of economic analysis for the reason that the possibility of a continued policy of public employment is something of which we have only recently become conscious in the United States. Should private investment and private indebtedness resume their erstwhile upward trend, then the problem of an increasing public debt would not arise. If, in fact, private investment has passed its zenith, we should perhaps look at an increasing public debt with less concern under such circumstances than a diminishing one. Prosperous capitalism appears to mean either a growing public debt or a growing private debt or both. During the moderately prosperous 1920's (table 1 and fig. 1), when the Federal debt was declining from approximately 24 billions in 1920 to 16 billions in 1930, public debt as a whole for all levels of Government actually increased by some 2 billions. Private indebtedness during the same period increased by between 30 and 35 billions. In all but 3 years during the decade of the twenties, between 6 and 11 billions of dollars worth of capital was added to the private capital equipment of the country. These were the companion pieces of increasing debt.

For several years beginning with 1930 we came somewhere near to an escape from our increasing debts.

TABLE 1.—*Public and private debt, and capital formation in the United States, 1920–38*

[In millions of dollars]

Year	Gross public debt [1]	Gross Federal debt [1]	Adjusted public debt [2]	Contingent liabilities [3]	Total private debt long-term		Net capital formation [6]	Net private durable capital formation [6]
					Bureau of Foreign and Domestic Commerce [4]	Leonard Kuvin[5] NICB		
1920	32,044	24,298	32,044	3,190	---------	46,237	11,650	870
1921	32,452	23,976	32,452	2,667	---------	46,682	3,683	967
1922	32,857	22,964	32,857	2,242	51,186	50,694	5,802	3,081
1923	32,948	22,350	32,948	2,329	---------	55,368	9,691	4,931
1924	32,884	21,251	32,884	1,965	---------	60,358	6,823	5,231
1925	33,346	20,516	33,346	1,730	---------	65,282	10,644	6,464
1926	33,307	19,643	33,307	1,779	---------	70,525	9,734	6,050
1927	33,245	18,510	33,245	1,884	---------	76,044	8,859	5,667
1928	33,303	17,604	33,303	1,736	---------	81,221	8,168	5,411
1929	33,691	16,931	33,691	1,802	---------	84,174	10,082	4,885
1930	34,170	16,185	34,170	1,567	84,730	85,747	3,879	−1,908
1931	35,861	16,801	35,861	2,046	---------	84,506	−278	−1,115
1932	38,817	19,487	38,090	2,475	---------	81,843	−4,513	−3,466
1933	42,056	22,539	40,668	4,253	---------	77,563	−3,506	−3,294
1934	45,376	27,053	43,906	5,295	74,300	77,127	−2,130	−2,232
1935	47,673	28,701	46,488	8,662	72,831	75,622	1,517	−809
1936	52,757	33,545	51,783	10,033	71,459	74,742	5,524	1,351
1937	55,579	36,427	54,781	10,190	70,335	74,304	8,182	2,946
1938	56,337	37,167	55,540	10,312	---------	---------	---------	---------

[1] For period up to June 30, 1930 see *Long Term Debts in the United States* by D. C. Horton, Bureau of Foreign and Domestic Commerce 1937, table 76, p. 171. For period subsequent to this date see *Annual Report of the Secretary of the Treasury for the Fiscal Year Ended June 30, 1938*, p. 493 for revised Federal gross debt figures and p. 544 for revised figures of State and local issues outstanding (combine for total public debt figure). These are all as of June 30.

[2] The "Adjusted Public Debt" is derived from the "Gross Public Debt" by deducting therefrom Reconstruction Finance Corporation loans to private institutions as reflected in the U. S. Fiscal Files (1) Balance Sheet of Assets and Liabilities (2) Governmental Corporations and Agencies, Assets and Liabilities, as of June 30, 1929–33, and for the period from 1934–38, inclusive, see the *Annual Report of the Secretary of the Treasury for Fiscal Year Ended June 30, 1938.*

[3] For Postal Savings figures prior to 1934 see *Operations of the Postal Savings System* June 30, 1920 to June 30, 1934; U. S. Post Office Department, comparative balance sheets contained therein. Data concerning Federal Reserve System prior to 1934 drawn from *Annual Reports of the Federal Reserve Board 1920–1933.* These data are as of June 30 except for 1920 which is as of July 2. For 1934 see *Annual Report of the Secretary of the Treasury for Fiscal Year Ended June 30, 1935* p. 57; for 1935 and 1936 material see *Annual Report of Secretary of the Treasury for Fiscal Year Ended June 30, 1936*, p. 67; and for 1937 and 1938, *Annual Report of the Secretary of the Treasury for Fiscal Year Ended June 30, 1938.*

[4] Totals for 1922 and 1930 computed from data by D. C. Horton, *Long Term Debts in the United States*, Bureau of Foreign and Domestic Commerce, 1937: "Farm Mortgage Debt," table 51, p. 107; "Urban Realty Debt," p. 139; "Railway Debt," table 6 p. 39; "Industrial", p. 93; "Public Utility", table 18, p. 55. For totals for other years see article by J. Wesley Sternberg, "Trend of Long-Term Debts in the United States, 1934–37" in *Survey of Current Business*, Bureau of Foreign and Domestic Commerce, January 1939, vol. 19, No. 1, table 1, p. 11. Horton's estimates are as of January 1; Sternberg's, end of calendar year.

[5] See article by Leonard Kuvin, "Private and Public Debt in the United States" *Conference Board Bulletin*, October 27, 1938, vol. 12, No. 11, p. 94.

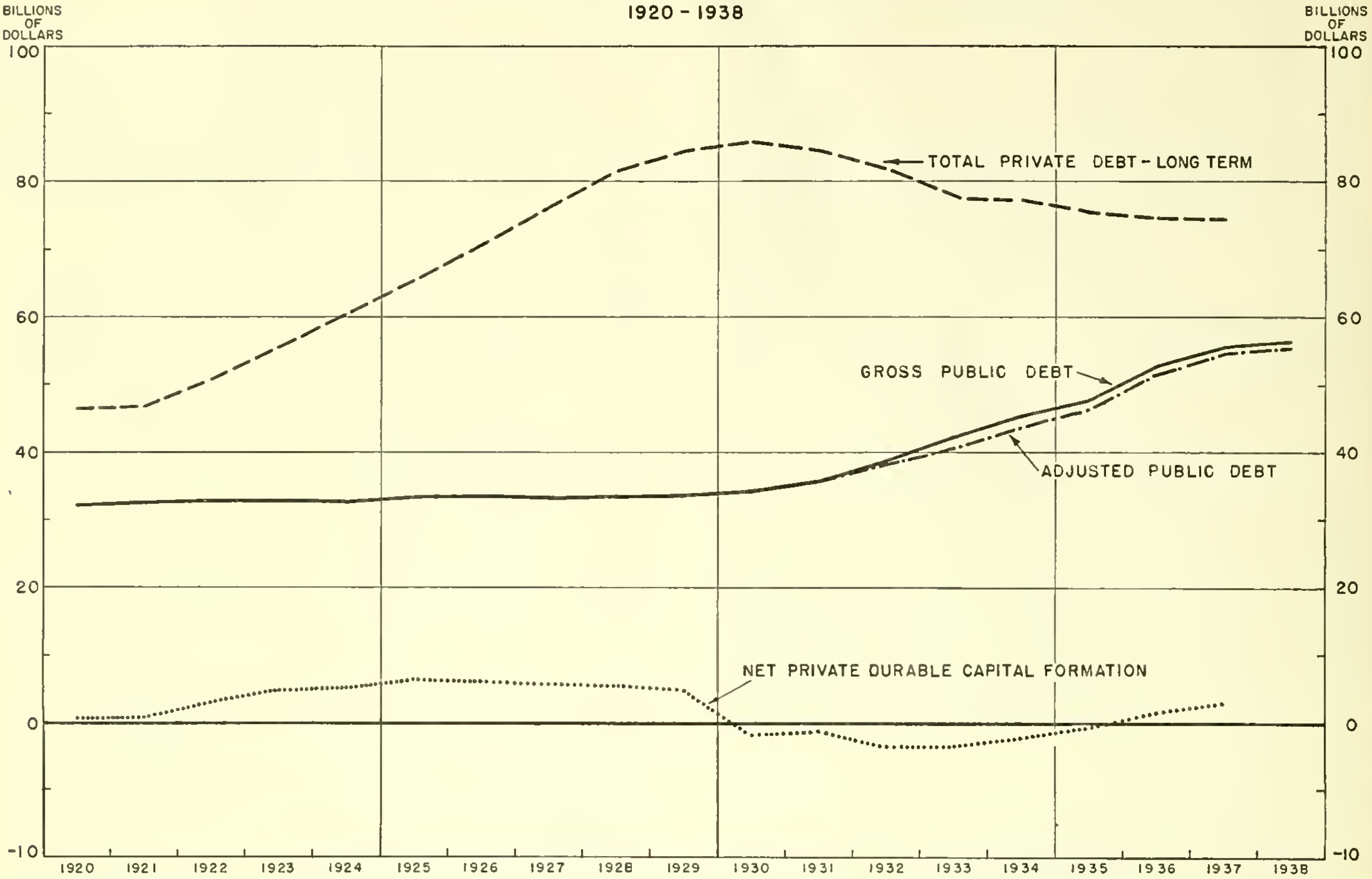
[6] For years 1920 to 1931 inclusive, see Simon Kuznets, *National Income and Capital Formation*, National Bureau of Economic Research, 1937, p. 48. For years from 1932 to 1937 inclusive, see Simon Kuznets, *Commodity Flow and Capital Formation In The Recent Recovery and Decline, 1932–38*, National Bureau of Economic Research, Bull. 74, June 25, 1939, p. 2.

All classes of public debt increased from 1930 to 1934 by about 11 billions, but private debt declined by an almost similar amount. The total debt of the country remained almost constant. The accompanying situation was, to put it mildly, unsatisfactory; the private

FIG. 1 - APPENDIX A

COURSE OF INDEBTEDNESS AND CAPITAL FORMATION

1920 - 1938



SOURCE: SEE FOOTNOTE TO TABLE I

capital plant of the country showed a net depreciation in every year, and it reached an estimated maximum of nearly 4½ billions in 1932. National income fell by half. Since 1934 the increase in public debt has been more rapid, while the decline in private debt has been at a less rapid rate. Private capital formation and national income have both recovered somewhat. The purpose of this discussion is not to "prove" a cause and effect relationship between the course of indebtedness and the course of business prosperity; it is to indicate that active capitalism and increasing debt are partners.

State and Local Public Debt

The issues concerning the national debt just discussed are not entirely relevant to the case of State and local governments. Again, however, it is necessary to proceed in a cautious and rather tentative way, for little exploratory work has been done on the subject, and what has been done depends on weak or even false analogies between private and public experience.

To begin, it is clear that the supportable level of debt has limits in the case of local and State governments which it does not have in the Federal Government. This is partly an accident of the American political structure. The Constitution and subsequent political development gave to States and municipalities many of the most important and costly public functions. At the same time the Federal Government, partly by constitutional design and partly because it alone had the territorial competence to tax interstate activity, received a disproportionate share of the more fruitful tax bases. The effect of this, until recent times, was to make for extremely rapid extinguishment of the Federal debt whenever war or like emergency had created one; on two occasions the Federal Government has found itself with no debt, comparatively, and huge revenues pouring into the Treasury. State and local governments, with heavy expenses for education, communication, health, policing, and poor relief, and the heavily worked property tax as their main source of revenue, have never been so fortunate. Quite aside from statutory and constitutional limitations on indebtedness, the States and municipalities have always been closer than the Federal Government to the point where increased transfers on debt account might prove difficult.

There is a more important difference between the investment and debt-carrying ability of the different levels of government. The Federal Government is also the monetary authority and as such can always be assured of secure market for its bonds; it can, in fact, "make" its own market and its own terms. States and municipalities are not so situated. The terms at which they borrow are not subject to their own determination; they cannot, for example, insure the success of a bond issue by having the Federal Reserve System acquire an equivalent volume of securities from the market. Moreover, the creditors of a State or municipality are not necessarily the taxpayers of the same political unit; creditors and taxpayers have less tendency to overlap as groups.

A sharp line, as a consequence, must be drawn between the employment expenditure policy of the Federal Government and the debt which it can sustain, and the situation of State and local governments. To put the matter bluntly, the Federal Government has a large degree of freedom in the policies with which it offsets a low level of private and total investment. State and local governments are limited both by their less elastic revenues and by the fact that the terms on which they borrow are externally determined by banks and private investors. There is, in principle, no basic contradiction in the situation which has so frequently been observed in recent years, namely, balanced or pay-as-you-go budgets in States and localities while the Federal budget shows a systematic deficit. There is, even, no contradiction in the fact that some of the balanced State and local budgets were achieved by Federal aid; it may merely reflect the differing financial and debt-sustaining capacities of the two levels of government. This difference has been recognized in the non-Federal PWA program, in part through the grants to States and local governments and, even more directly, through the purchase of bonds of local governments. In actual practice this policy has been variously explained on grounds of expediency or the lesser willingness of State and local governments to engage in a program of public investment. It seems important to recognize that it has a clear-cut economic basis in the inherently different financial abilities of the different levels of government.

APPENDIX B—THE SECONDARY OR UNIDENTIFIABLE EFFECTS OF PUBLIC WORKS[1]

It will be apparent that only a part of the effects of public works on employment and income are measured in chapters III and IV. We have been concerned with the effects produced by what might be called the first spending of public works moneys: the amount of employment provided on the site of the project and in supplying it with materials, and with the amount of business created on the construction job and in construction supply industries. Obviously, this is not the whole story. Workers employed on public works projects have incomes to spend which they would not otherwise have, or their incomes are at least increased over what they would otherwise be. The same is true of the workers who are employed in the supply of materials. Contractors and concerns furnishing materials have added revenues at their disposal.

The further effect on employment of the spending and respending of these incomes is generally recognized, although there has been much controversy over its extent and the promptness with which it makes itself felt. Some have dismissed this secondary effect as diffused over time or largely hypothetical; others have added together slowly diminishing series of respendings at weekly or monthly intervals and have concluded that a phenomenally large employment must result from phenomenally small additions to the stream of income.

Unfortunately, none of the actual studies of the problem provides a wholly satisfactory answer, and there has been no possibility in the present study to open the matter up for detailed examination. As suggested presently there is, as a matter of fact, some doubt whether a figure for secondary employment and income can be arrived at in view of the numerous factors acting to change its value from one period of time to the next. An approach to the problem, in any case, will require detailed field studies which trace the enhanced course of spending in actual cases through and across retail and wholesale enterprise and to the production of goods with determination at each stage of its effect on employment. This would be a lengthy and costly task, and it might also be an inconclusive one.

In the light of the discussion of the problem in recent years and the experience during the same period there are, however, some significant generalizations to be made on the problem. It is clear, to begin, that the secondary effects of increased employment must not be exaggerated. It is easy to conjure up pictures of the workers employing the baker, the baker the barber, the barber the butcher, and so forth, but these pictures invariably ignore some extremely important variables. Restricting attention for the time being to the effect of increased employment on further employment, there are some important leakages and lags to be considered. Under conditions of general unemployment, the worker who finds employment on a public works project does, in most cases, have an increased income to expend. The amount of his pay check will not always be a net addition to his expenditures, however, for he was managing to live in some fashion before. If he were drawing on reserves, going into debt, or had WPA employment, these amounts must be deducted from his new wages to get at the net increase in his spending, and there must be partial deductions if he were living on charity or drawing on friends and relatives. If, with employment, he undertakes to retire debt or accumulate some reserve, there must be a further adjustment. This latter effect may be discounted somewhat, for if unemployment has continued for some time the pressure of sheer subsistence needs, including such items as depleted clothing inventories, will be great. There will be a tendency here, how strong one cannot tell, for full expenditure of all the increased income that can be released.

The situation in the areas where the worker spends his income is important, and the picture here is somewhat clearer. If it is a time of general unemployment, we are certain to have excess capacity, not only of the plant for producing and distributing goods or services, but in some degree of employed personnel as well. The obvious case here is when the net increase in the worker's spending comes to the retail store. This industry, during depression, does not readjust its personnel downward to accord closely with shrinking business[2] and increasing business does not necessarily involve any corresponding expansion of employment. No doubt a similar situation holds for the wholesale distributive trades and perhaps also for transportation. The incidence of the increased expenditure of the worker in the second instance is on increased income for the distributors, where debt retirement and the low spending rate of profits may neutralize its further effect, and only then upon increased demand for goods. At certain times inventory changes, and for some classes of goods, price changes, may delay or neutralize the transfer of increased goods demand into increased employment demand. All of these effects are possible, in fact probable, under conditions of general unemployment.

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[1] The general problem of secondary employment and income has been discussed in detail by J. M. Clark, *The Economics of Planning Public Works*, National Planning Board, August 1935.

[2] The situation is obvious for "one-man" retailing enterprises. Undoubtedly it holds widely over the field of retailing.

This discussion is concerned with an increase in public works expenditure and employment during a period of general unemployment. It is apparent that the immediate effect on employment of the respending of increased incomes can be relatively small. However, if the reemployment be continued over a period of time, the situation will change somewhat. Accumulated debts of the worker will be repaid, some minimum cash reserve may perhaps be built up, and at some stage inventories will be reduced to normal or below, and inventory replacement will begin. The longer effect of reemployment itself is to clear away some of the obstacles to secondary employment, which, it is to be noted, must always be cleared away by some means before employment can be expanded. Over the longer period the effect of increased public works employment on total employment will certainly be different, and probably greater, than the immediate effect. Under any circumstances it is certain that a considerable amount of play must be expected between the provision of the primary employment and the realization of the secondary employment.

The second observation, which follows partly from the above, is that both the initial and eventual volume of secondary employment will vary considerably under different conditions, in particular with the stage of the cycle. The factors making for this variation seem to have been far too heavily discounted by those who have sought for the value of the employment or investment multiplier. As just noted, if unemployment is high and has persisted for some little time, if inventories are high and there is general excess capacity in the distributive fields, there need initially be little or no secondary employment. The worker uses some of his increased income to catch up on his back rent or to stay the importunities of a loan shark, and the rest moves some of the excess stocks of retailers, who in turn pay off some debt. While conditions are improved for the future, there is no secondary employment or (in broad definition) investment as the immediate result of the primary expenditure. If, on the other hand, the worker is free of debt and his position generally secure, and if inventories are promptly replaced and retail trade is moderately active, conditions will be different. The enhanced income will be promptly spent in the goods markets; the replacing of inventories will be reflected in increased industrial employment; and increased employment in transportation and distributive trades is a possibility. In a still more favorable situation, the replacement of inventories which are being depleted at a more rapid rate than before will have a multiplying effect on employment in consumers' goods industries, with a further multiplying effect on capital goods industries if this causes increased investment by producers of consumer's goods.[3] Under such circumstances the neutralizing effect of price increases and profit expansion will be greater than when activity is at a lower level, but secondary employment from the respending of the enhanced income (or directly induced by it) will be far in excess of the primary employment.

To conclude, the volume of secondary employment associated with any given volume of primary employment is a variable with two dimensions of change. The initial effects of an increase in employment will be different from (and probably less than) the effects of enhanced employment over a period of years. In either case, the volume of secondary employment will vary with the volume of unemployment, the atmosphere of security or insecurity, and the volume of excess capacity in the economy. In other words it will alter with the long-run employment situation and with the stage of the business cycle. This variation suggests the illusory character of any effort to reduce the problem of secondary employment to strict quantitative terms.

Two observations follow with respect to the experience of the last 6 years. In the first place, the increase of public works and work relief expenditure in 1933 and 1934 probably, on balance, met an unfavorable situation so far as secondary employment was concerned. There was certainly excess capacity of plant and employed personnel. Debts had accumulated, and there were sizable stocks of goods in many lines, especially of food products. Under the circumstances expectations of secondary employment probably erred on the side of optimism. By 1936, it is a reasonable guess, a given volume of primary employment created a markedly greater secondary employment.

In the second place, at no time since 1933 has either public works or work relief policy been so designed as to maximize secondary employment. On the basis of the preceding discussion, it would be expected that a 6-year period would have ironed out any differences between the initial and the eventual effects of increased employment. However, the public works and the work relief programs since 1933 have not been single programs; they have each been a series of programs and each year's work has been undertaken on the assumption that it would be the last or would lead to the wind-up. Uncertainty has always attended the new appropriations, and in the work relief program there have been occasional administrative changes and occasional need for cutting down on employment for lack of funds. The result is that neither PWA nor WPA employment has at any time been secure employment. Although sheer subsistence needs make it impossible for workers to reduce their expenditures very much, this uncertainty has doubtless operated to reduce the volume of secondary employment during this period.

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[3] The operation, in other words, of what has been called the "relation" of technical economic analysis.

APPENDIX C—STATISTICAL MATERIALS USED IN CHAPTER III

Methods of Estimating Total Values of Production at the Mill

The classification of Federal material orders, as reported by contractors to the Bureau of Labor Statistics, is similar to that used in the Biennial Census of Manufactures. Consequently, for the years 1935 and 1937, Biennial Census figures of total production value at mill have been used.

For five materials, estimates of quarterly production (at mill) were made for the period 1934–38. These estimates were compiled as follows:

Lumber and Timber Products (*Table 9*).—The annual values of production in 1933, 1935, and 1937 given in the *Biennial Census of Manufactures* were distributed quarterly in those years according to the monthly production series (quantity) for all types of lumber (a much broader classification) compiled by the National Lumber Manufacturers Association. The figures for 1934, 1936, and 1938 were estimated, on the basis of the same production series, by interpolation (extrapolation in the case of 1938) plus adjustments for price movements according to the average changes in the composite prices of western and southern pine. As a check on the above method, it was used to calculate production in 1933 and 1937 by extrapolation with 1935 as a base. The results were compared with the *Biennial Census* totals. The errors were found to be minus 8½ percent in 1933 and a plus 5 percent in 1937. Presumably the errors are smaller for 1934 and 1936, since interpolation was possible.

Brick, Tile, and Clay Products (*Table 10*).—The annual totals of production for 1934, 1935, and 1937 were taken from the *Biennial Census of Manufactures*. The quarterly distribution in those years and all the figures for 1936 and 1938 were calculated as follows: The monthly census series of shipments and stocks for common brick, face brick, and hollow building tile (approximately a 60 percent sample in each case) were used to determine a quantity production series, which in turn was adjusted to the *Biennial Census* figures and the movements in the Bureau of Labor Statistics series of the wholesale price of common brick in order to provide quarterly value figures. The three commodities represent about 35 percent of the entire classification.

Cement (*Table 11*).—Monthly production as reported by the Bureau of Mines was multiplied by the composite wholesale price for the respective months as compiled by the Bureau of Labor Statistics. The resulting amounts, converted into quarterly figures, were adjusted to the annual values of shipments as calculated from information in the *Pit and Quarry Handbook*. The discrepancies averaged only 2½ percent, so that the quarterly figures can be considered reasonably accurate.

Cast-Iron Pipe and Fittings (*Table 12*).—The monthly series of cast-iron fittings production (approximately a 10 percent quantity sample), compiled by The Valve and Fittings Institute, was converted into a production index with a 1935 base, and applied to the average quarterly value of production in 1935 as determined from the *Biennial Census of Manufactures*. The resulting totals were adjusted to the *Biennial Census* figures for 1933 and 1937, the interpolations in 1934 and 1936 and the extrapolation in 1938 being guided by the price trends of composite finished and structural steel. (The errors were a plus 10 percent in 1933 and a plus 5 percent in 1937.) The annual totals were compared with relative changes in the incomplete quantity production figures reported by the Iron and Steel Institute, and the correlation proved good except in 1936. Extrapolating forward from 1935 and backward from 1937, an average error of minus 8.3 percent was discovered, and the 1936 totals were increased by that amount. In summary, the annual totals for 1935 and 1937 are correct, and any error in the other figures probably does not exceed 10 percent.

Fabricated Structural and Reinforcing Steel (*Table 13*).—The annual total values for fabricated structural steel and reinforcing steel for 1935 and 1937 were taken from the *Biennial Census of Manufactures* and distributed quarterly according to the monthly production figures of heavy (prefabricated) structural steel compiled by the Iron and Steel Institute. For 1934, 1936, and 1938, the production series for heavy structural steel was multiplied by the monthly series of structural steel prices compiled by the Bureau of Labor Statistics, and the resulting values were converted into an index with 1935 as base year. By applying the average quarterly value of fabricated structural and reinforcing steel for 1935 to the index, rough estimates for 1934, 1936, and 1938 were obtained. Checking this method by comparing its results for 1937 with the *Biennial Census* figures, an error of a little under 3 percent was found.

Sand and Gravel and Crushed Stone (*Table 14*).—Values of total annual production are from the *Minerals Yearbook*, Bureau of Mines. It is probable that the total output is underestimated as a result of incomplete reporting. On the other hand, the allowances for delivery costs (60 percent of total delivered cost for sand and gravel and 47 percent for crushed stone) are liberal and probably exceed substantially the delivery costs in many localities.

The quarterly and annual values of material orders on projects financed wholly or partially from Federal funds were supplied from the Bureau of Labor Statistics records.

Methods of Estimating Delivered Prices of Construction Supplies

As the *Biennial Census of Manufactures* excludes transportation charges wherever possible, it was necessary to make rough estimates of the freight costs to be added to the manufacturers' sales prices of various commodities in order to obtain price series which would be comparable with PWA and total Federal orders, since the latter are prices at the site of construction. The following methods were employed:

Lumber and Timber Products.—The average railroad freight cost was given as $283 for every $1,000 value in Senate Document No. 12, 73d Congress, *A National Plan for American Forestry,* March 13, 1933, vol. II, p. 1358. Certain other figures showing detailed delivery costs of oak, western pine, southern pine, and Douglas fir to the New York and the Chicago markets were available in *Economic Problems of the Lumber and Timber Products Industry* by Peter A. Stone, and others, NRA Work Materials 79, Industry Studies Section, March 1936, exhibit I, p. 333. The average freight charges were 41.4 percent (of mill price plus freight) to New York, and 36.4 percent to Chicago. However, in the absence of any better country-wide averages it was decided to adjust the mill price series on the basis of allowing 28 percent of the delivered value for transportation. Thus, the mill prices of lumber were divided by 72 percent to obtain the delivered prices for lumber Plant prices of planing mill products were adjusted similarly.

Brick, Tile, and Clay Products.—Data could be obtained only for common brick. The only available source was Senate Document No. 12, 73d Congress, *A National Plan for American Forestry,* March 13, 1933, vol. II, p. 1358. The average freight charges were given as $198 for every $1,000 value, and on the basis of a 20 percent allowance for transportation the plant price quotations were adjusted to allow for delivery costs.

Cement.—The average factory value per barrel was obtained from the *Minerals Yearbook* published annually by the Bureau of Mines. Then freight revenues per short ton were calculated from data found in *Freight Commodity Statistics for Class I Steam Railways in the United States,* issued annually by the Bureau of Statistics of the Interstate Commerce Commission. Freight revenues were divided by the number of tons of traffic originated. Since the Bureau of Mines estimates one barrel of cement contains 376 pounds, the Interstate Commerce Commission tonnage figures were converted to barrels on the basis of 5.32 barrels per ton. The average freight cost per barrel was then added to the average factory value per barrel to obtain the delivered value per barrel for each year from 1933 to 1937 inclusive. The percentage that freight costs constituted of the delivered price was found and averaged for the 5-year period. The price series was then adjusted for this factor (freight costs = 26 percent of delivered value). This is almost identical to the figure of $263 of freight charges for every $1,000 value given in Senate Document No. 12 previously cited. Prices of concrete products were adjusted on the same basis.

Cast-Iron Pipe and Fittings.—Senate Document No. 12, cites $79 as the average freight charge per $1,000 of value for iron and steel products. This figure compares with one of 9 percent (for products made within a 50-mile radius of Pittsburgh) based on a study made during the NRA period by the American Iron and Steel Institute, *Supplement No. 1 to NRA Report on the Operation of the Basing Point System in the Iron and Steel Industry,* March 12, 1935. The percentage of invoiced delivery value of freight added to basing point prices, however, was 7.2. Therefore, it was decided that an 8 percent allowance based on the average freight charge as stated in Senate Document No. 12 (above cited) was the one to be used in making the price adjustments. The same adjustment for delivered price was made for fabricated structural and reinforcing steel; elevators and elevator equipment; metal doors, shutters, etc.; plumbing supplies; engines, turbines, etc.; tools, other than machine tools; heating equipment and stoves and ranges; pumps and pumping equipment; electrical machinery, supplies, etc.; nails and spikes; miscellaneous hardware; foundry and machine shop products; sheet metalwork; bolts, nuts, washers, etc.; steel works and rolling mill products; rails and fastenings; wrought-iron pipe, and machine tools.

Sand and Gravel and Crushed Stone.—The average freight revenues per ton as computed from the Interstate Commerce Commission *Freight Commodity Statistics* were added to the average value per ton for each year as reported by the Bureau of Mines in the *Minerals Yearbook.* The proportion of freight costs to delivered value was found for each year and then averaged. A figure of 47 percent was used in estimating the total delivered value of crushed stone, and 60 percent was the freight allowance used in making the delivered price estimates for sand and gravel.

Marble, Granite, and Other Stone.—The procedure described above was followed with respect to these construction supplies. An average freight percentage of 29 percent was applied in estimating delivered values.

Wall Plaster, Wall and Insulating Board.—The average freight per ton based on the Interstate Commerce Commission *Freight Commodity Statistics* was added to the value per ton of the product described as "Gypsum, Calcined, for building purposes" in the *Minerals Yearbook.* This includes plasters, Keene's cement. wallboard, plasterboard, and lath, etc. The percentage of freight costs to delivered value for each year was then determined, and averaged for the 5-year period and the resultant figure, 27 percent, was used in adjusting the plant price.

No basis could be found for estimating the delivered prices of explosives, roofing materials, furniture, paints and varnishes, or petroleum products.

APPENDIX D—STATISTICAL MATERIALS USED IN CHAPTER VI

The following tables present data supporting the figures in Chapter VI for which tables are not included in the body of the chapter;

TABLE A.—*Percentage of total man-hours provided monthly for different project types, according to size groups*

Months after beginning of construction	Buildings						Highway construction and paving				Water mains	
	$1 to $24,999	$25,000 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over	$1 to $49,999	$50,000 to $99,999	$100,000 to $199,999	Over $200,000	$50,000 to $99,999	$100,000 to $499,999
First	2.0	6.5	3.2	1.5	.6	1.0	6.2	6.0	7.4	4.2	2.8	3.5
Second	17.0	10.0	9.4	3.9	2.0	3.3	20.4	13.4	14.8	19.3	18.0	8.9
Third	18.4	15.0	13.7	6.1	3.3	3.7	16.5	13.5	15.5	17.4	25.9	9.0
Fourth	17.6	16.3	15.2	7.6	4.5	3.8	11.7	14.0	15.9	18.6	22.5	8.1
Fifth	17.7	16.1	11.9	9.7	4.6	5.2	8.9	12.3	13.0	14.3	15.4	12.4
Sixth	16.1	13.4	12.1	10.6	6.9	6.8	9.4	11.4	9.6	18.4	10.8	9.8
Seventh	7.6	9.5	10.5	10.9	7.7	7.5	13.3	10.4	6.7	5.4	3.9	10.4
Eighth	1.9	5.8	9.2	11.3	7.7	5.6	5.9	6.6	6.5	1.4	.7	4.9
Ninth	1.5	4.1	6.6	8.8	8.7	6.2	4.3	6.9	5.7	1.0		5.5
Tenth	.2	1.4	3.4	7.9	9.0	5.1	2.4	2.7	3.1			5.0
Eleventh		1.1	2.5	6.6	7.4	4.1	1.0	1.5	1.2			4.1
Twelfth		.3	1.9	5.1	7.0	4.4		.3	.1			1.9
Thirteenth		.4	.4	3.4	6.7	4.0		.2	0			2.4
Fourteenth		.1		3.3	6.1	3.4		.3	0			.6
Fifteenth				1.8	5.4	3.9		.5	0			0
Sixteenth				.8	4.1	3.7			.1			1.3
Seventeenth				.5	3.3	3.1			.1			2.9
Eighteenth				.1	2.3	2.8			0			3.5
Nineteenth				.1	1.3	2.8			.2			3.9
Twentieth					1.0	2.3			.1			1.9
Twenty-first					.6	1.9						
Twenty-second					.5	1.6						
Twenty-third					.2	.7						
Twenty-fourth					.1	.4						
Twenty-fifth						.5						
Twenty-sixth						1.6						
Twenty-seventh						1.4						
Twenty-eighth						1.9						
Twenty-ninth						1.8						
Thirtieth						1.7						
Thirty-first						1.6						
Thirty-second						1.0						
Thirty-third						.9						
Thirty-fourth						.6						
Thirty-fifth						.4						
Thirty-sixth						.3						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Months after beginning of construction	Highway bridges			City street paving		Grade-crossing elimination		Diesel and steam-engine plants		
	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$50,000 to $99,999	$100,000 to $199,999	$50,000 to $99,990	$100,000 to $499,999	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999
First	12.8	5.7	3.0	6.0	3.3	5.3	.8	4.8	1.1	2.8
Second	24.5	10.8	10.5	20.1	8.0	13.0	4.1	32.5	6.7	7.8
Third	17.8	13.6	8.6	30.9	18.7	14.3	5.4	35.5	6.7	15.3
Fourth	13.3	17.3	12.7	23.1	21.1	15.4	8.4	10.9	12.8	15.1
Fifth	11.7	13.7	13.9	13.7	20.0	20.6	9.2	15.4	11.0	15.1
Sixth	6.8	14.1	13.9	4.3	15.3	12.4	10.6	.9	10.2	11.3
Seventh	4.8	13.2	14.6	1.9	11.6	8.9	12.6		12.7	13.5
Eighth	2.1	9.2	9.6		2.1	2.8	12.3		14.3	5.9
Ninth	3.1	1.4	6.1			2.5	8.1		12.1	2.9
Tenth	2.7	1.0	3.5			3.1	5.5		6.2	1.7
Eleventh	.4		1.3			.6	2.3		3.5	5.6
Twelfth			1.0			1.1	2.7		1.5	1.6
Thirteenth			.7				3.0		1.2	1.3
Fourteenth			0				3.7			.1
Fifteenth			.1				4.7			
Sixteenth			.5				4.0			
Seventeenth							2.2			
Eighteenth							.4			
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE A.—*Percentage of total man-hours provided monthly for different project types, according to size groups*—Continued

Months after beginning of construction	Sewage disposal and treatment plants				Pumping plants and filtration plants				Sewers				Low-cost housing	
	$50,900 to $99,999	$100,000 to $499,999	$500,000 to $999, 999	$1,000,000 and over	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999, 999	$1 to $19,999	$50,000 to $99,999	$100,000 to $499,999	$1,000,000 and over	$500,000 to $999,999	$1,000,000 and over
First	5.6	1.1	0.4	1.0	6.5	3.9	1.5	0.3	19.4	3.0	2.8	1.4	0.3	0.1
Second	7.0	3.1	2.0	4.5	14.8	11.7	3.0	1.6	28.8	12.8	6.0	9.6	.5	.3
Third	12.0	2.8	3.1	6.9	19.6	14.4	4.6	13.7	18.3	19.8	7.8	14.9	1.0	.2
Fourth	11.0	4.3	6.1	8.7	19.7	17.2	10.4	16.8	15.8	17.8	11.9	16.9	2.4	.9
Fifth	10.7	7.1	5.1	10.6	25.5	15.5	15.7	14.8	8.5	14.6	14.5	13.6	1.1	1.8
Sixth	16.6	8.6	6.1	8.7	10.5	11.6	15.6	9.8	3.6	7.6	11.6	14.0	.2	2.4
Seventh	11.6	9.6	11.3	8.2	3.4	8.9	12.2	5.9	4.1	11.2	13.0	8.1	.4	2.8
Eighth	12.0	10.2	11.4	8.4	--------	5.3	8.9	4.4	1.6	7.8	11.7	7.4	2.7	2.3
Ninth	7.5	10.0	15.4	5.3	--------	6.1	6.7	2.4	--------	3.4	9.7	5.8	6.7	1.6
Tenth	4.5	9.2	13.8	5.9	--------	3.0	5.0	5.5	--------	1.3	4.6	4.4	7.3	9.2
Eleventh	1.5	9.2	13.1	4.4	--------	.8	3.8	3.7	--------	.8	2.6	3.6	10.2	4,6
Twelfth	--------	7.0	5.8	3.5	--------	1.1	3.0	4.8	--------	--------	2.1	.3	15.0	603
Thirteenth	--------	2.5	2.4	3.4	--------	.6	2.9	4.0	--------	--------	.3	--------	12.5	139
Fourteenth	--------	2.1	1.1	3.1	--------	--------	3.0	3.0	--------	--------	0	--------	17.0	5.8
Fifteenth	--------	2.2	1.6	4.2	--------	--------	1.4	2.1	--------	--------	0	--------	12.1	7.4
Sixteenth	--------	2.3	1.2	3.4	--------	--------	.7	2.5	--------	--------	0	--------	9.4	8.2
Seventeenth	--------	2.3	.1	3.4	--------	--------	.4	1.8	--------	--------	.4	--------	1.2	9.4
Eighteenth	--------	2.6	--------	2.1	--------	--------	.4	1.2	--------	--------	.6	--------	0	8.0
Nineteenth	--------	1.4	--------	1.8	--------	--------	.2	1.0	--------	--------	.4	--------	--------	673
Twentieth	--------	1.5	--------	1.1	--------	--------	.1	.7	--------	--------	.1	--------	--------	6. .
Twenty-first	--------	.9	--------	.5	--------	--------	0	--------	--------	--------	--------	--------	--------	5. .
Twenty-second	--------	0	--------	.2	--------	--------	0	--------	--------	--------	--------	--------	--------	4. .
Twenty-third	--------	.1	--------	.3	--------	--------	0	--------	--------	--------	--------	--------	--------	2.6
Twenty-fourth	--------	--------	--------	.2	--------	--------	0	--------	--------	--------	--------	--------	--------	1.6
Twenty-fifth	--------	--------	--------	.1	--------	--------	.5	--------	--------	--------	--------	--------	--------	.6
Twenty-sixth	--------	--------	--------	.1	--------	--------	.4	--------	--------	--------	--------	--------	--------	.4
Twenty-seventh	--------	--------	--------	.1	--------	--------	.3	--------	--------	--------	--------	--------	--------	.1
Twenty-eighth	--------	--------	--------	--------	--------	--------	.2	--------	--------	--------	--------	--------	--------	.1
Twenty-ninth	--------	--------	--------	--------	--------	--------	.1	--------	--------	--------	--------	--------	--------	--------
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Months after beginning of construction	Hydroelectric plants			Heavy bridges			Flood control			Triborough Bridge, over $1,000,000	Philadelphia subway, over $1,000,000	Pennsylvania Railroad electrification, over $1,000,000	Midtown Tunnel, over $1,000,000
	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over				
First	5.1	1.6	0	0.8	0.5	0.9	0.2	0.9	0.4	0	0.1	0.2	0.1
Second	6.8	5.4	.4	5.3	2.2	2.6	2.8	2.1	2.1	.3	.4	.9	.4
Third	8.3	5.4	.5	8.4	4.1	4.4	3.8	3.7	2.9	.5	1.0	1.8	.8
Fourth	11.2	7.1	.4	10.7	6.0	3.9	4.1	3.2	1.9	.6	2.6	2.9	.7
Fifth	7.6	5.9	.9	11.0	6.1	4.3	6.6	3.1	1.2	.7	4.3	4.2	.7
Sixth	7.6	6.4	1.3	13.2	4.2	5.2	7.1	4.2	1.6	1.1	5.2	5.6	1.1
Seventh	7.9	6.5	1.5	9.2	8.4	4.5	7.2	2.8	3.3	1.1	7.5	7.7	.9
Eighth	6.6	14.0	1.8	8.2	6.7	5.1	4.4	2.8	3.8	1.6	7.4	8.0	1.2
Ninth	3.8	12.9	1.3	2.7	4.4	5.2	3.8	1.5	5.1	1.7	6.5	8.2	1.3
Tenth	5.0	13.2	1.5	2.5	5.9	5.8	1.3	1.3	6.1	1.6	7.7	9.2	1.0
Eleventh	5.2	10.5	1.6	2.4	4.2	6.5	.1	1.7	8.6	.9	5.7	7.5	1.3
Twelfth	6.3	5.4	1.5	1.4	3.2	5.4	1.4	2.0	7.3	1.2	4.0	7.2	1.5
Thirteenth	7.2	2.8	1.4	2.2	2.4	5.9	3.8	1.8	6.7	1.7	3.3	6.7	1.6
Fourteenth	4.7	1.8	1.5	4.0	2.4	6.4	7.2	4 3	8.3	2.9	4.1	6.4	1.7
Fifteenth	2.8	.5	1.0	2.6	4.0	5.3	7.5	5.3	5.4	2.7	4.2	6.8	1.5
Sixteenth	1.9	.4	1.0	2.7	4.7	5.8	9.0	6.3	3.2	2.7	5.3	5.9	1.4
Seventeenth	1.9	.2	.8	3.7	4.4	3.5	6.1	9.2	1.4	2.6	4.8	4.1	1.4
Eighteenth	.1	--------	2.5	3.3	5.4	4.2	7.9	7.4	1.2	2.3	4.2	2.6	1.3
Nineteenth	--------	--------	4.5	2.7	5.5	3.0	7.1	7.9	2.0	2.1	3.2	2.1	1.9
Twentieth	--------	--------	4.5	1.6	6.1	1.8	4.1	5.0	2.0	2.3	2.6	1.0	2.3
Twenty-first	--------	--------	5.4	1.0	3.7	1.5	.9	3.4	2.4	3.1	2.8	.3	2.2
Twenty-second	--------	--------	5.3	.2	3.4	1.5	1.5	1.4	2.8	3.3	3.2	.6	1.8
Twenty-third	--------	--------	5.8	.1	1.9	.8	.7	1.0	4.5	2.7	1.9	.1	1.8
Twenty-fourth	--------	--------	5.8	0	.2	.7	.5	1.4	4.9	4.0	2.1	--------	1.7
Twenty-fifth	--------	--------	6.2	.1	--------	.7	.9	3.0	6.2	7.7	1.1	--------	2.6
Twenty-sixth	--------	--------	6.5	--------	--------	.7	--------	2.4	2.9	8.8	1.9	--------	2.8
Twenty-seventh	--------	--------	5.1	--------	--------	.6	--------	3.3	1.8	9.7	1.3	--------	3.0
Twenty-eighth	--------	--------	3.6	--------	--------	.6	--------	4.0	--------	9.5	.8	--------	3.3
Twenty-ninth	--------	--------	3.8	--------	--------	.6	--------	2.2	--------	4.6	.7	--------	3.3
Thirtieth	--------	--------	4.6	--------	--------	1.3	--------	1.4	--------	3.8	0	--------	3.6
Thirty-first	--------	--------	4.4	--------	--------	.8	--------	--------	--------	2.6	.1	--------	3.5
Thirty-second	--------	--------	4.6	--------	--------	.4	--------	--------	--------	2.9	--------	--------	3.8
Thirty-third	--------	--------	3.3	--------	--------	0	--------	--------	--------	1.6	--------	--------	3.0

TABLE A.—*Percentage of total man-hours provided monthly for different project types, according to size groups*—Continued

Months after beginning of construction	Hydroelectric plants			Heavy bridges			Flood control			Triborough Bridge over $1,000,000	Philadelphia subway over $1,000,000	Pennsylvania Railroad electrification over $1,000,000	Midtown Tunnel over $1,000,000
	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over				
Thirty-fourth			2.1			0.1				1.0			2.4
Thirty-fifth			.9			0				.5			2.2
Thirty-sixth			.8			0				.5			2.0
Thirty-seventh			.6			0				.8			2.3
Thirty-eighth			.1							1.3			2.3
Thirty-ninth			.3							.7			2.7
Fortieth			.7							.2			2.3
Forty-first			.2							.2			2.8
Forty-second													2.7
Forty-third													2.7
Forty fourth													2.8
Forty-fifth													2.2
Forty-sixth													1.3
Forty-seventh													1.2
Forty-eighth													.9
Forty-ninth													.9
Fiftieth													1.3
Fifty-first													1.0
Fifty-second													1.0
Fifty-third													1.0
Fifty-fourth													.9
Fifty-fifth													.5
Fifty-sixth													0
Fifty-seventh													.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE B.—*Percentage of total man-hours worked, wage earners employed, payroll disbursements made, and material orders placed, monthly according to size groups*

Months after beginning of construction	Man-hours					Wage earners employed				
	$1 to $49.999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$10,00,000 or over
First	8.9	4.0	2.7	0.7	0.3	11.3	5.7	4.4	1.4	0.6
Second	18.4	12.1	7.1	2.2	1.1	15.7	12.1	7.2	2.7	1.4
Third	16.9	15.1	8.6	4.3	1.7	16.3	14.4	8.9	4.6	2.1
Fourth	14.3	15.8	10.5	5.8	2.4	14.5	14.7	10.5	5.2	2.7
Fifth	12.8	13.1	11.0	5.3	3.1	11.0	12.5	10.8	5.7	3.3
Sixth	8.8	11.1	10.6	5.3	4.0	9.3	10.4	10.3	5.6	4.0
Seventh	6.4	10.4	9.7	6.3	5.0	6.7	9.7	9.7	6.1	4.4
Eighth	3.9	7.6	8.3	6.6	5.2	5.4	7.9	8.0	6.9	4.5
Ninth	4.5	5.6	6.2	7.1	5.0	4.5	5.4	6.1	7.0	4.6
Tenth	1.6	2.6	5.0	7.7	5.6	2.4	3.5	5.2	7.6	4.7
Eleventh	1.2	1.4	3.8	6.9	4.8	1.0	2.1	4.0	6.8	4.3
Twelfth	1.1	.7	2.7	6.4	4.8	.8	1.0	2.9	6.3	4.2
Thirteenth	.9	.2	2.3	5.4	4.7	.7	.2	2.2	5.7	4.2
Fourteenth	.3	.1	2.3	5.8	4.9	.4	.2	2.1	5.0	4.4
Fifteenth		.2	1.9	5.2	5.1		.2	1.7	4.8	4.4
Sixteenth			1.7	4.5	4.7			1.5	4.4	4.2
Seventeenth			1.4	3.3	3.8			1.2	3.2	3.6
Eighteenth			1.0	2.6	3.5			.8	2.5	3.2
Nineteenth			.9	2.2	2.8			.6	2.0	2.8
Twentieth			.6	1.8	2.3			.5	1.9	2.5
Twenty-first			.3	1.1	2.3			.3	1.2	2.4
Twenty-second			.2	.8	1.9			.2	.9	2.1
Twenty-third			.2	.4	1.5			.2	.5	1.7
Twenty-fourth			.3	.3	1.4			.2	.2	1.7
Twenty-fifth			.3	.3	1.8			.2	.4	1.9
Twenty-sixth			.3	.3	1.9			.2	.3	2.1
Twenty-seventh			.1	.5	1.9			0	.3	2.2
Twenty-eighth				.4	1.9			0	.4	2.0
Twenty-ninth				.3	1.2			.1	.3	1.5
Thirtieth				.2	1.2				.1	1.4
Thirty-first					1.0					1.2
Thirty-second					1.0					1.1
Thirty-third					.6					1.0

TABLE B.—*Percentage of total man-hours worked, wage earners employed, payroll disbursements made, and material orders placed, monthly according to size groups*—Continued

Months after beginning of construction	Man-hours					Wage earners employed				
	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over
Thirty-fourth	---	---	---	---	0.5	---	---	---	---	0.7
Thirty-fifth	---	---	---	---	.4	---	---	---	---	.5
Thirty-sixth	---	---	---	---	.3	---	---	---	---	.5
Thirty-seventh	---	---	---	---	.4	---	---	---	---	.5
Thirty-eighth	---	---	---	---	.4	---	---	---	---	.6
Thirty-ninth	---	---	---	---	.4	---	---	---	---	.5
Fortieth	---	---	---	---	.4	---	---	---	---	.6
Forty-first	---	---	---	---	.3	---	---	---	---	.5
Forty-second	---	---	---	---	.3	---	---	---	---	.4
Forty-third	---	---	---	---	.4	---	---	---	---	.4
Forty-fourth	---	---	---	---	.3	---	---	---	---	.4
Forty-fifth	---	---	---	---	.3	---	---	---	---	.4
Forty-sixth	---	---	---	---	.1	---	---	---	---	.3
Forty-seventh	---	---	---	---	.2	---	---	---	---	.1
Forty-eighth	---	---	---	---	.1	---	---	---	---	.2
Forty-ninth	---	---	---	---	.1	---	---	---	---	.1
Fiftieth	---	---	---	---	.2	---	---	---	---	.2
Fifty-first	---	---	---	---	.1	---	---	---	---	.1
Fifty-second	---	---	---	---	.1	---	---	---	---	.2
Fifty-third	---	---	---	---	.1	---	---	---	---	.1
Fifty-fourth	---	---	---	---	.1	---	---	---	---	.1
Fifty-fifth	---	---	---	---	.1	---	---	---	---	.1
Fifty-sixth	---	---	---	---	---	---	---	---	---	.1
Fifty-seventh	---	---	---	---	---	---	---	---	---	---
Fifty-eighth	---	---	---	---	---	---	---	---	---	---
Fifty-ninth	---	---	---	---	---	---	---	---	---	---

Months after beginning of construction	Payroll disbursements made					Material orders placed				
	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over
First	7.9	4.3	2.1	0.6	0.2	10.1	9.7	7.3	0.4	1.0
Second	17.9	12.2	5.8	1.9	1.0	24.0	14.8	6.5	2.2	3.6
Third	16.4	14.8	7.7	3.6	1.6	15.9	15.4	10.6	4.7	5.0
Fourth	14.2	15.6	10.0	4.8	2.0	12.5	12.6	12.0	8.0	3.6
Fifth	13.5	13.2	10.4	4.8	2.7	12.0	10.2	10.4	5.4	4.6
Sixth	9.0	11.3	11.4	5.2	3.4	9.2	9.5	10.8	4.9	3.5
Seventh	7.4	10.5	10.0	6.5	4.2	6.2	9.0	10.5	6.4	3.8
Eighth	4.3	7.7	8.8	6.9	4.3	2.8	8.0	6.5	7.5	3.0
Ninth	4.8	5.4	6.4	7.4	4.2	3.4	4.3	4.7	5.2	3.2
Tenth	1.6	2.5	5.2	7.8	4.7	1.7	3.2	4.5	8.9	3.1
Eleventh	1.1	1.3	4.1	7.1	4.2	.6	1.4	2.8	8.9	2.3
Twelfth	.9	.8	3.1	6.4	4.3	1.2	1.6	2.5	6.0	3.8
Thirteenth	.7	.2	2.6	5.6	4.4	.4	.1	3.1	9.6	3.1
Fourteenth	.3	.1	2.8	5.5	4.7	---	.2	2.4	3.8	3.2
Fifteenth	---	.1	2.1	5.1	5.0	---	---	1.5	3.4	3.5
Sixteenth	---	---	1.8	4.6	4.8	---	---	1.0	3.7	3.7
Seventeenth	---	---	1.4	3.8	3.9	---	---	.9	2.1	6.2
Eighteenth	---	---	1.0	2.9	3.4	---	---	.4	2.2	3.7
Nineteenth	---	---	.9	2.4	3.2	---	---	.5	2.8	2.6
Twentieth	---	---	.5	2.1	2.6	---	---	.1	1.5	2.3
Twenty-first	---	---	.4	1.3	2.7	---	---	.5	1.0	2.7
Twenty-second	---	---	.2	1.1	2.3	---	---	0	.6	1.9
Twenty-third	---	---	.2	.5	1.7	---	---	.1	.3	1.6
Twenty-fourth	---	---	.3	.2	1.6	---	---	.2	.1	1.7
Twenty-fifth	---	---	.4	.4	2.1	---	---	.1	.2	2.3
Twenty-sixth	---	---	.3	.3	2.3	---	---	0	0	2.0
Twenty-seventh	---	---	0	.4	2.3	---	---	.1	.1	2.2
Twenty-eighth	---	---	0	.4	2.3	---	---	---	.1	2.2
Twenty-ninth	---	---	.1	.3	1.6	---	---	---	---	1.8
Thirtieth	---	---	---	.1	1.4	---	---	---	---	1.3
Thirty-first	---	---	---	---	1.2	---	---	---	---	1.3
Thirty-second	---	---	---	---	1.2	---	---	---	---	1.2
Thirty-third	---	---	---	---	.9	---	---	---	---	1.6
Thirty-fourth	---	---	---	---	.6	---	---	---	---	.5
Thirty-fifth	---	---	---	---	.5	---	---	---	---	.5
Thirty-sixth	---	---	---	---	.5	---	---	---	---	.9

TABLE B.—*Percentage of total man-hours worked, wage earners employed, payroll disbursements made, and material orders placed, monthly according to size groups*

Months after beginning of construction	Payroll disbursements made					Material orders placed				
	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 or over
Thirty-seventh	---------	---------	---------	---------	0.4	---------	---------	---------	---------	0.6
Thirty-eighth	---------	---------	---------	---------	.6	---------	---------	---------	---------	.8
Thirty-ninth	---------	---------	---------	---------	.5	---------	---------	---------	---------	.5
Fortieth	---------	---------	---------	---------	.4	---------	---------	---------	---------	.6
Forty-first	---------	---------	---------	---------	.5	---------	---------	---------	---------	.5
Forty-second	---------	---------	---------	---------	.5	---------	---------	---------	---------	.4
Forty-third	---------	---------	---------	---------	.5	---------	---------	---------	---------	.6
Forty-fourth	---------	---------	---------	---------	.4	---------	---------	---------	---------	.3
Forty-fifth	---------	---------	---------	---------	.4	---------	---------	---------	---------	.3
Forty-sixth	---------	---------	---------	---------	.2	---------	---------	---------	---------	.1
Forty-seventh	---------	---------	---------	---------	.2	---------	---------	---------	---------	.1
Forty-eighth	---------	---------	---------	---------	.2	---------	---------	---------	---------	.5
Forty-ninth	---------	---------	---------	---------	.2	---------	---------	---------	---------	.3
Fiftieth	---------	---------	---------	---------	.2	---------	---------	---------	---------	.4
Fifty-first	---------	---------	---------	---------	.2	---------	---------	---------	---------	.1
Fifty-second	---------	---------	---------	---------	.2	---------	---------	---------	---------	.1
Fifth-third	---------	---------	---------	---------	.1	---------	---------	---------	---------	.2
Fifty-fourth	---------	---------	---------	---------	.2	---------	---------	---------	---------	.1
Fifty-fifth	---------	---------	---------	---------	0	---------	---------	---------	---------	.1
Fifty-sixth	---------	---------	---------	---------	0	---------	---------	---------	---------	.1
Fifty-seventh	---------	---------	---------	---------	0	---------	---------	---------	---------	---------
Fifty-eighth	---------	---------	---------	---------	0	---------	---------	---------	---------	---------
Fifty-ninth	---------	---------	---------	---------	.1	---------	---------	---------	---------	---------

TABLE C.—*Months required to reach specific stages of completion by project types and average contract sizes*

Type of project	Average contract size	Months required to reach specific percentage of completion		
		30 percent	60 percent	90 percent
Buildings	$18,300	2.6	4.3	6.1
	36,400	2.9	4.8	7.6
	74,200	3.2	5.6	8.8
	220,500	5.2	7.8	12.0
	686,400	7.2	10.7	15.7
	2,162,100	6.9	13.2	27.7
Pumping and filtration plants	35,400	2.4	4.0	5.4
	69,200	3.0	4.9	8.3
	214,500	4.7	6.8	12.2
	624,500	3.9	6.5	13.8
Water mains	53,100	2.3	3.6	5.5
	216,200	4.1	6.8	[1] 11.7
	2,613,200	4.8	9.2	12.7
Highway bridges	43,000	1.7	3.4	6.7
	63,300	3.0	4.9	7.2
	133,100	3.6	5.8	8.5
Highway construction and paving	28,800	2.2	4.6	7.6
	74,700	2.8	5.1	8.4
	133,900	2.5	4.5	8.1
	337,600	2.4	4.0	5.9
City street paving	36,000	1.3	1.9	2.7
	78,800	2.1	3.3	5.2
	144,400	2.8	4.3	6.4
Sewers	39,600	1.4	2.6	4.9
	70,700	2.8	4.5	7.4
	151,100	4.1	6.4	9.2

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[1] Adjustment made for weather.

Table D.—*Monthly distribution of total man-hours provided by $10,000,000 of projects, by size groups*

Months after beginning construction	Buildings						Highway construction and paving			Water mains		Sewers		
	$1 to $24,999	$25,000 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$500,000 to $999,999	$1,000,000 and over	$1 to $49,999	$50,000 to $99,999	$100,000 to $199,999	$50,000 to $99,999	$100,000 to $499,999	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999
First	86.5	230.5	120.3	46.1	17.4	25.4	122.9	257.4	356.7	92.7	100.9	1,169.5	105.6	116.8
Second	735.6	354.7	353.4	120.0	58.2	84.0	844.9	574.8	713.4	596.0	256.6	1,736.1	450.6	250.3
Third	796.1	532.0	516.1	187.7	96.0	94.2	445.5	579.1	747.2	857.6	259.5	1,103.2	697.1	325.4
Fourth	760.5	578.1	571.6	233.8	130.9	96.7	486.5	600.5	766.5	745.0	233.6	952.4	626.7	496.5
Fifth	765.8	571.0	447.4	298.5	133.8	132.3	189.5	527.6	626.7	509.9	257.5	512.4	514.0	604.9
Sixth	696.6	475.2	454.9	326.2	171.6	173.1	594.0	489.0	462.8	357.6	282.6	217.0	264.0	484.0
Seventh	328.8	336.9	394.8	335.4	223.9	190.9	1,141.9	446.1	323.0	129.1	299.9	247.0	394.3	542.4
Eighth	82.2	205.7	345.9	347.7	223.9	142.5	460.9	283.1	313.0	23.2	141.3	247.2	274.6	488.1
Ninth	64.9	145.4	248.1	270.8	253.0	132.3	435.3	296.0	274.8	---	158.6	90.4	119.7	404.7
Tenth	8.7	49.7	127.8	243.1	261.7	129.8	281.6	115.8	149.4	---	144.2	---	45.8	191.9
Eleventh	---	39.0	94.0	203.1	215.2	104.3	117.8	64.3	57.8	---	118.2	---	28.2	104.3
Twelfth	---	10.6	71.4	156.9	203.5	111.8	---	12.9	4.8	---	54.8	---	---	87.6
Thirteenth	---	14.2	15.0	104.6	194.8	101.8	---	8.6	0	---	69.2	---	---	12.5
Fourteenth	---	3.5	---	101.5	177.4	86.5	---	12.9	0	---	17.3	---	---	0
Fifteenth	---	---	---	55.4	157.0	99.3	---	21.4	0	---	0	---	---	0
Sixteenth	---	---	---	24.6	119.2	94.2	---	---	4.8	---	37.5	---	---	0
Seventeenth	---	---	---	15.4	96.0	78.9	---	---	4.8	---	83.6	---	---	16.7
Eighteenth	---	---	---	3.1	66.9	71.3	---	---	9.6	---	100.9	---	---	25.0
Nineteenth	---	---	---	3.1	37.8	71.3	---	---	4.8	---	112.5	---	---	16.7
Twentieth	---	---	---	---	29.1	58.5	---	---	---	---	54.8	---	---	4.1
Twenty-first	---	---	---	---	17.4	48.4	---	---	---	---	---	---	---	---
Twenty-second	---	---	---	---	14.5	40.7	---	---	---	---	---	---	---	---
Twenty-third	---	---	---	---	5.8	17.8	---	---	---	---	---	---	---	---
Twenty-fourth	---	---	---	---	2.9	10.2	---	---	---	---	---	---	---	---
Twenty-fith	---	---	---	---	---	12.7	---	---	---	---	---	---	---	---
Twenty-sixth	---	---	---	---	---	40.7	---	---	---	---	---	---	---	---
Twenty-seventh	---	---	---	---	---	35.6	---	---	---	---	---	---	---	---
Twenty-eighth	---	---	---	---	---	48.4	---	---	---	---	---	---	---	---
Twenty-ninth	---	---	---	---	---	45.8	---	---	---	---	---	---	---	---
Thirtieth	---	---	---	---	---	43.3	---	---	---	---	---	---	---	---
Thirty-first	---	---	---	---	---	40.7	---	---	---	---	---	---	---	---
Thirty-second	---	---	---	---	---	25.4	---	---	---	---	---	---	---	---
Thirty-third	---	---	---	---	---	22.9	---	---	---	---	---	---	---	---
Thirty-fourth	---	---	---	---	---	15.3	---	---	---	---	---	---	---	---
Thirty-fifth	---	---	---	---	---	10.2	---	---	---	---	---	---	---	---
Thirty-sixth	---	---	---	---	---	7.6	---	---	---	---	---	---	---	---

TABLE D.—*Monthly distribution of total man-hours provided by $10,000,000 of projects, by size groups*—Continued

Months after beginning construction	Pumping plants and filtration plants			Highway bridges			Sewage disposal and treatment plants		City street paving		Grade crossing elimination	
	$1 to $49,999	$50,000 to $99,999	$100,000 to $499,999	$1 to $49,999	$50,000 to $99,999	$100,000 to $199,999	$50,000 to $99,999	$100,000 to $499,999	$50,000 to $99,999	$100,000 to $199,999	$50,000 to $99,999	$100,000 to $499,999
First	248.6	135.6	43.5	535.8	265.8	96.7	236.3	44.6	256.4	89.6	182.5	34.6
Second	543.1	406.8	87.1	1,025.6	503.5	338.4	295.4	125.7	858.8	217.2	447.7	177.2
Third	749.6	500.7	133.5	745.2	634.1	277.2	506.4	113.5	1,320.3	507.7	492.5	233.4
Fourth	738.2	598.0	301.8	556.8	806.6	409.4	464.2	174.3	987.0	572.9	530.3	363.0
Fifth	1,013.5	538.9	455.6	489.8	638.8	448.0	451.6	287.8	585.4	543.0	709.4	397.6
Sixth	401.6	399.9	452.7	284.7	657.4	448.0	700.6	344.6	183.7	415.4	427.0	458.1
Seventh	130.0	309.5	354.1	200.9	615.4	470.6	489.5	389.2	81.2	312.2	306.5	544.6
Eighth		184.3	258.3	87.9	428.9	309.4	506.4	413.5		57.0	96.4	531.6
Ninth		212.1	165.4	129.8	65.3	196.6	316.5	405.4			86.1	350.1
Tenth		104.3	145.1	113.0	46.6	112.8	189.9	373.0			106.8	237.7
Eleventh		27.8	110.3	16.7		41.9	63.3	373.0			20.7	99.4
Twelveth		38.2	87.1			32.2		283.8			37.9	116.7
Thirteenth		20.9	84.2			22.6		101.3				129.7
Fourteenth			87.1			0		85.1				159.9
Fifteenth			40.6			3.2		89.2				203.1
Sixteenth			20.3			16.1		93.2				172.9
Seventeenth			11.6					93.2				95.1
Eighteenth			11.6					105.4				17.3
Nineteenth			5.8					56.8				
Twentieth			2.9					60.8				
Twenty-first			0					36.5				
Twenty-second			0					0				
Twenty-third			0					4.0				
Twenty-fourth			0									
Twenty-fifth			14.5									
Twenty-sixth			11.6									
Twenty-seventh			8.7									
Twenty-eighth			5.8									
Twenty-ninth			2.9									

GLOSSARY

1. *Public Works.*—All construction activity undertaken by Federal, State, or local governments, exclusive of work relief and financed with public money. The term usually implies durable, immobile types of construction of a nonmaintenance character.

a. Regular or "Normal" Public Works.—Construction activity undertaken by Federal, State, or local governments, presumably without reference to cyclical or secular conditions of employment.

b. Construction Financed Wholly or Partially from Federal Funds.—Public works projects for which the Federal Government or its agencies furnish all or part of the necessary funds through direct expenditures, loans, or grants-in-aid.

c. Regular Federal Construction.—Construction authorized by the provisions of regular departmental supply bills and financed entirely from Federal funds.

d. Federal-Aid Highways.—Roads (and in some cases, bridges and grade crossing elimination) constructed or maintained by the States with funds supplied partially by the Bureau of Public Roads.

e. Federal PWA Projects.—Projects conducted by Federal agencies and financed entirely from Federal funds through PWA allocations.

f. Non-Federal PWA Projects.—Projects conducted by States and localities with Federal grants-in-aid or loans, or a combination of the two. This classification also includes projects conducted by individuals or private corporations but financed partially by PWA loans.

2. *Work Relief Construction.*—Primarily construction of a light nature requiring relatively small amounts of equipment and materials, and planned largely in relation to the job requirements of those to be employed. Workers are taken from relief rolls, and emphasis is placed on large volume of unskilled employment per dollar of cost in order to relieve unemployment.

3. *Primary Effects of Public Works Expenditure.*—The effect of the initial expenditure of Government funds, i. e., the amount of employment provided on the site of the project, and the amount of production and employment stimulated in the construction supply industries by the public works material orders.

4. *Secondary Effects of Public Works Expenditure.*—Employment and business activity resulting from the further spending and respending of incomes by those who received the original public outlays as income, including expenditures of those engaged in supplying materials.

5. *Grants-in-aid.*—Money given outright by the Federal Government to States and localities to finance their public-works programs.

6. *Time Pattern.*—The stage of completion of a project or program at a series of time intervals after the start of construction.

7. *Labor Pattern.*—The number of man-hours of employment given by a project at a series of time intervals after the start of construction.

8. *Force Account Work.*—Work done directly by a governmental agency, not through a contractor, with labor hired for that purpose.

9. *On-site Employment.*—Employment on the site in carrying out the construction of a project.

10. *Off-site Employment.*—Employment resulting from administration of a construction project and the manufacture and transportation of the materials used on a project.

11. *Employment Creating Value or Employment Efficiency.*—The amount of on-site and off-site employment per dollar of expenditure generated by a public-works program or project.

12. *Allotment.*—The official administrative designation of a sum of money set aside for a specific works project.

13. *Authorization.*—Legislative action sanctioning a works program or project.

14. *Award of contract.*—Authorization given by a Government body or agency to a private contractor to perform construction work on a specific public-works project. This precedes the completion of certain legal and financial details after which the contract agreement is executed.

15. *Abbreviations.*—

A. F. of L.	American Federation of Labor.
BLS	Bureau of Labor Statistics, U. S. Department of Labor.
BPR	Bureau of Public Roads.
CCC	Civilian Conservation Corps.
CWA	Civil Works Administration.
ENR	Engineering News-Record.
ERA	Emergency Relief Appropriation Act 1935.
FDA	First Deficiency Appropriation Act 1936.
FERA	Federal Emergency Relief Act.
N. E. C.	Not Elsewhere Classified.
NICB	National Industrial Conference Board.
NIRA	National Industrial Recovery Act.
PWA	Public Works Administration, or Federal Emergency Administration of Public Works.
PWAA	Public Works Administration Appropriation Act 1938.
PWAE	Public Works Administration Extension Act 1937.
RFC	Reconstruction Finance Corporation.
WPA	Works Progress Administration.
USHA	United States Housing Authority.

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